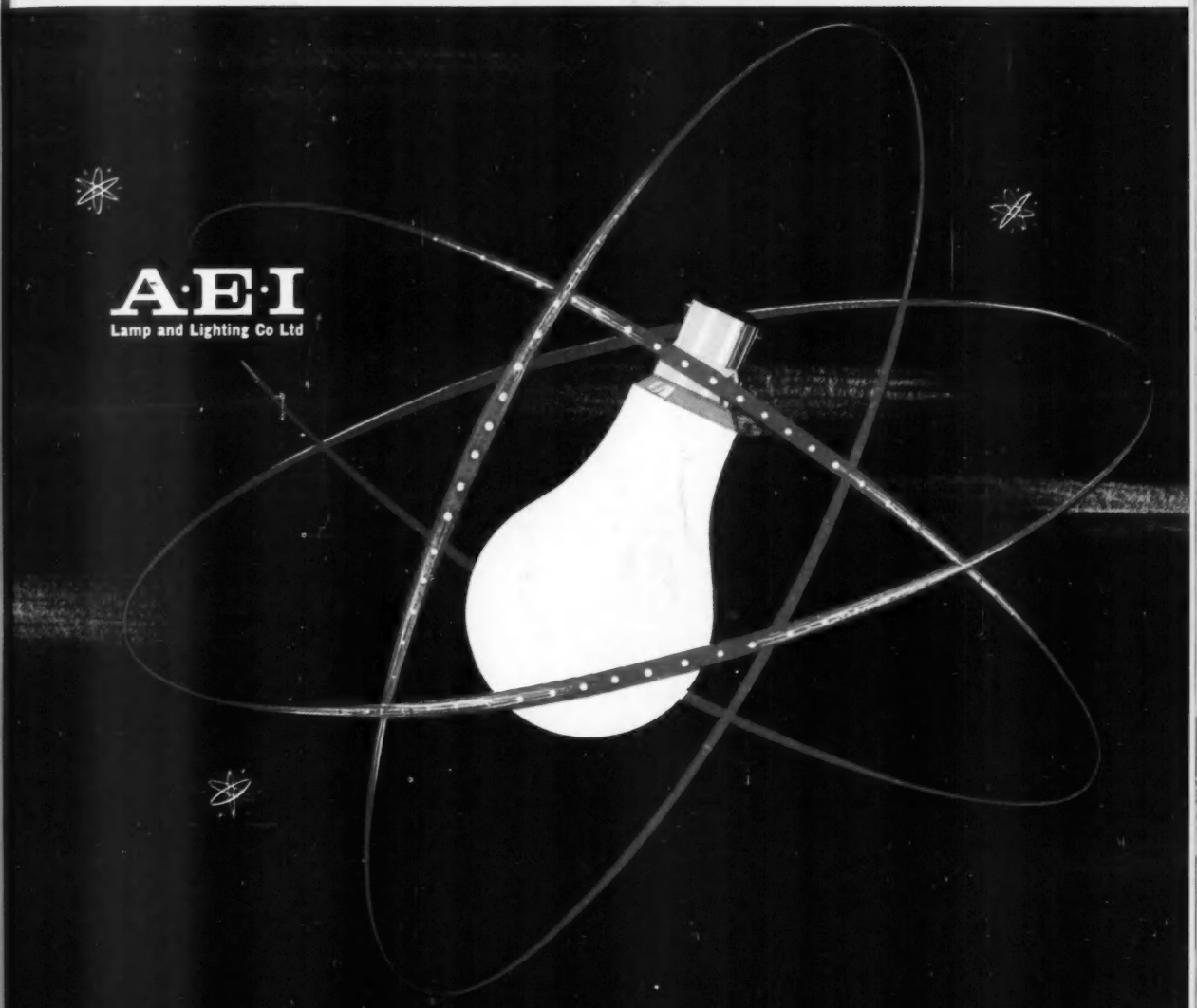
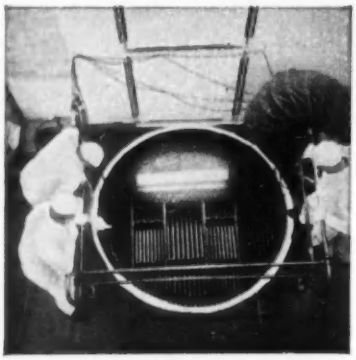
ELECTRICAL REVIEW



Mazda *lamps stay brighter longer*

Head Office: Melton Road, Leicester



Clean conditions for pressure vessels at Berkeley

Boilermaking is not usually associated with clinical cleanliness. But with nuclear power plant, conditions are different. In the heat-exchangers at Berkeley Nuclear Power Station, John Thompson's men are working in special clothing, with clean white gloves. They enter the vessels through sealed "pent-houses" erected at the top of the heat-exchangers. The tube packs, which they fit into the vessels, arrive in sealed polythene wrappings. No incompatible materials are allowed to enter. The atmosphere is controlled — no corrosion must occur.

This is just another example of careful planning, work done to schedule, and an ability *to get on with the job no matter what the conditions*. It is typical of John Thompson.

JOHN THOMPSON WATER TUBE BOILERS LIMITED - JOHN THOMPSON GROUP

JOHN THOMPSON WATER TUBE BOILERS LIMITED - WOLVERHAMPTON

WTA29

ELECTRICAL REVIEW

13 November 1959 Vol. 165 No. 14 Established 1872

Automatic Control of Power Stations

SINCE the end of the war, the development of plant for thermal power stations has been on a grand scale. Most of the generating units which were on order when the supply industry was nationalised, eleven years ago, were rated either at 30 MW or 60 MW. Nowadays the " standards " are 120 MW and 200 MW, and these seem likely to rise before long, since a 550 MW cross-compound set is in course of manufacture. The accent has therefore been on increasing the size of both generators and boilers, principally to raise the overall thermal efficiency of generation. However, there will be a limit to unit sizes because of transport difficulties and the maximum economic size of individual units connected to the grid.

Attention is now being devoted to the automatic control of power stations. A start has been made at Little Barford " B " where an integrated automatic electronic control system has been installed for the boilers supplying steam to the two 60 MW sets. This is the first time that a British power station has been provided with such a control system. Two power stations in Canada have been equipped with equipment of the same type and make and the system has been working satisfactorily for about three years.

Another step towards the more economic generation of electricity was the commissioning of the new grid control centres of the Central Electricity Generating Board last year. The automatic control system at Little Barford, which is fully described in this issue, covers that part of the production of electricity from the pulverising mills to the superheater outlets. The next step will most likely be to sense load variations at the alternator terminals instead of at the turbine inlet.

One of the main advantages of electronic control is that additional facilities can be added without trouble. The control system includes a number of simple computers which relate various physical measurements to a predetermined algebraic function. The computer formula can be altered easily according to requirements. Three-term process controllers are also used in this system and it is a simple matter to adjust the relation of the proportional, integral and derivative terms operating on the input signal. Other advantages of this type of control include the elimination of water, steam and other fluids from the control loop. There is thus no danger of a leak in the control loop and installation costs show that it is less expensive to run telephone type cables than to install fluid lines. Miniature

instruments and recorders associated with this kind of system allow a more compact arrangement of the main control room. Boiler control has always been a very complicated process since there are so many variables which must be taken into account. Most of these problems have now been solved by the introduction of this flexible automatic electronic control system. It appears that Little Barford will set a pattern for future British power stations and the Central Electricity Generating Board is to be congratulated on installing such a large integrated system as a prototype.

THE DERIAZ TURBINE

In his article comparing the Kaplan and Deriaz turbines (see page 647) Mr. P. Deriaz outlines the advantages that result from his mixed-flow design of variable-pitch runner. There is no doubt that for this type of machine many applications will be found and realised in the future. Indeed, the field for these applications has so far by no means been fully explored. Particularly in the reversible pump-turbine field, as is required for the storage of energy by hydraulic means, the mixed-flow Deriaz design is the only example of a centrifugal pump that can be controlled in its power input over wide ranges and with high efficiencies. This is essential for high heads and in the case of very large unit sizes. This consideration also permits a high flexibility of service on the pump cycle compared to that on the turbine cycle. It is this flexibility which has caused the hydraulic turbine prime mover to be so greatly appreciated for peak load generation. The fact that it can now be obtained on the pump cycle is of great importance.

HOME OR EXPORT ?

Sales of British electrical goods to the Common Market countries increased by 10 per cent during the first three quarters of this year. It might well be concluded, therefore, that earlier forecasts of the depressing effect that European integration would have on British exports were too pessimistic. But, as Mr. U. M. Spencer of the G.E.C.'s Economic and Marketing Research Unit pointed out in a recent lecture at a course organised by the Federal Trust and Britain in Europe, the position is by no means so happy when individual products are considered.

With the exception of vacuum cleaners, British domestic electrical appliances have done badly this year in Europe. This decline has taken place during a period of unprecedented boom in domestic appliances at home, and it is pertinent to ask how far the two are connected. To what extent have goods that might have been exported been diverted to the home trade? It is surely short-sighted, as Mr. Spencer pointed out, to let what have been profitable markets satisfy their need from elsewhere.

RAILWAY ELECTRIFICATION

It is now over five years since the International Railway Congress was held in London and then electrification was only one of the subjects discussed. We supplemented the proceedings by publishing at that time a special issue in which various features of railway electrification were dealt with by acknowledged authorities. Shortly afterwards (January, 1955) the British Transport Commission published its report on "The Modernisation and Re-equipment of British Railways" and the theme of the 1956 British Electrical Power Convention was "Electricity and Transport."

Since then there has been no comprehensive survey of the subject in this country and so the British Railways Electrification Conference arranged for next October is not being held too soon. It is the intention of the British Transport Commission to show overseas railwaymen what is being done here, particularly in the way of 25 kV 50 c/s electrification which will be well advanced by the date of the Conference.

As the organisers (the B.T.C., the B.E.A.M.A. and the Locomotive Manufacturers' Association) expect 300 or 400 delegates from abroad to attend the Conference, and these will see a comprehensive exhibition as well as working examples, there should be good results both from the national prestige and export aspects.

CABLE RATIONALISATION

The latest move in the reorganisation of the electric cable-making industry is to take the form of a new company which will acquire the power cable business of Enfield Cables, Ltd., and Standard Telephones & Cables, Ltd. The Enfield company has had an eventful history. Enfield Ediswan Cable Works, Ltd., was formed in 1919 to take over the Enfield Cable Manufacturing Co. and the cable business of the Edison Swan Electric Co. Four years later the Edison Swan company drew out and the word "Ediswan" was dropped from the title. Subsequently the name was changed to the present style.

In 1953, as the outcome of an inquiry made on behalf of the shareholders, there was a reorganisation. Earlier this year the company was acquired by Enfield Rolling Mills, Ltd., which, strangely enough, began life in 1924 as a subsidiary of Enfield Cables.

Other recent developments in the industry have been the acquisition of Henley's by Associated Electrical Industries and of Scottish Cables by British Insulated Callender's; and the decisions to close the North Woolwich factory of Henley's and the Bootle works of the Liverpool Electric Cable Co.

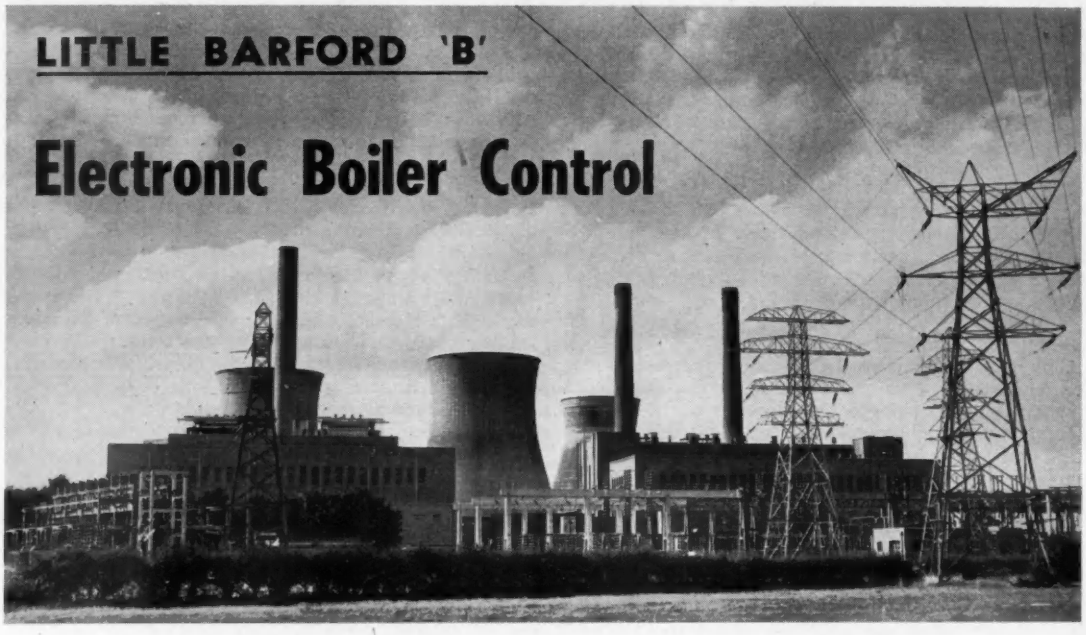
SEMICONDUCTOR MANUFACTURE

The manufacture of transistors and allied semiconductor devices is a very complicated business but in the ten years or so since these useful circuit elements were first introduced great progress has been made. One example is provided by the Hazel Grove, Stockport, factory of the G.E.C., which is referred to in this issue, where a very high production rate is being maintained while there is an extremely low rate of rejection of finished semiconductor devices.

During the past year or so we have visited a number of semiconductor factories; they are all basically similar but the present plant embodies some interesting new approaches to the problems involved. For instance, rather than trying to achieve very high, almost clinical, cleanliness throughout the entire factory, a generally high, but not unreasonable, standard is maintained within the plant, with scrupulous local cleanliness for particular stages of manufacture where this is vital.

LITTLE BARFORD 'B'

Electronic Boiler Control



Analogue computers and three-term process controllers are the essential components of the first comprehensive installation in this country of an electronic system of automatic boiler control. Other unusual features at this station are a valveless unit circulating water system with three-stage variable-pitch impeller c.w. pumps, outdoor boilers and a dry ash and dust plant

FUTURE fully automatic factories will depend upon computers for overall and individual machine control. The level of stocks of raw materials will be determined from the state of the order book and the necessary manufacturing programmes selected. A completely automatic power station could operate on the same principles. Load demands would determine fuel input and programmes for starting up and shutting down would be selected as required. The first step in this direction has been taken at Little Barford power station with the installation of an electronic automatic boiler control system designed and manufactured by Evershed & Vignoles, Ltd. This system covers the process of the production of electricity from the fuel input to the steam before the turbine. Load variations are sensed and firing alterations effected. The next step will be to sense alterations in electrical demand instead of in the steam conditions.

Little Barford "B," which is situated on the east bank of the Great Ouse, 1½ miles south of St. Neots, contains two 60 MW turbo-alternator/boiler units. All coal is delivered by rail to the sidings which are served from the main King's Cross/Edinburgh railway line. When the original station was designed at the beginning of the last war, the intention was that the whole site should be developed for a total of 240 MW. Little Barford "A" was completed during the last war and contained four 30 MW sets, and some preliminary work on the design of the "B" station, with two 60 MW sets, was carried out in 1940. The first set in the Little Barford "B" station (No. 5) was commissioned on 30th March last and the second set (No. 6) on 22nd October.

The "A" and "B" station site consists of dense, sandy gravel approximately 10ft thick 6ft below the surface overlaying stiff blue clay. It was therefore decided that block foundations would be used to a depth of approximately 8ft 6in below the surface. The turbine house is of steel-framed construction with brick cladding, while the boilers are of outdoor construction. Additional administration accommodation, workshops and coal conveyor structures have been built to serve the new station. The original station could be described as a riverside installation with cooling tower boosting and only one cooling tower was provided for the four sets in the "A" station. The "B" station, however, has a closed unit c.w. system and two further towers have been built, one for each 60 MW set, make-up water only being obtained from the Ouse.

Both stations are at present operated on a two-shift basis. The total cost of Barford "A," on completion, was about £2·4 million, equivalent to £20/kW of installed plant capacity (4×30 MW sets), and the estimated cost of the completed "B" station is about £6¼ million, equivalent to £52/kW installed plant capacity.

Steam Raising Plant

Coal from the bunkers is fed into the top of Foster Wheeler horizontal drum-type pulverising mills with separate exhausters. The Foster Wheeler boiler for each unit is of single-drum construction with a maximum

continuous evaporative capacity of 550 klb/hr. The steam pressures and temperatures at the superheater outlet are 950 p.s.i. and 925°F. There are eight p.f. burners in the front wall of each boiler as well as eight Associated British Combustion oil ignition burners. Both primary and secondary superheaters are in the back section of the boiler together with the economisers and tubular air heaters.

The final steam temperature control is effected by varying the dryness fraction of the saturated steam entering the primary superheater by means of a hollow tube surface condenser. In normal circumstances, this condenser uses hot feed water led out after the regulating valve supplying the water to the boiler.

Boiler and Combustion Control

The main elements of the Evershed electronic boiler control system are transmitters, three-term process controllers, simple analogue computers and positioners. The quantity to be controlled is translated into an electrical signal in a transmitter. The principle of operation employed permits the simultaneous display and recording of the desired information at several points in the plant. In a number of cases, the signal from a transmitter is applied to a simple computer which will relate various physical measurements according to a predetermined algebraic function. In general, the output signal of the computer is then employed to amend a controller signal in accordance with the formula. In the process controller, the signal is compared with a signal representing the desired value and any difference between the two signals, i.e. any deviation from desired conditions, is used to generate a three-term output signal which will control a regulating unit accordingly. The regulating units at Little Barford take the form of Evershed electro-hydraulic positioners which accurately regulate the dampers and valves to maintain the required operating conditions.

The use of this electronic control system excludes all water, steam and other fluids from the control room, and the control panel contains a wide range of miniature recorders and indicators in a compact form. In most cases, the electrical signal takes the form of a small direct current which varies from 0 to 30 mA for the full range being measured or controlled.

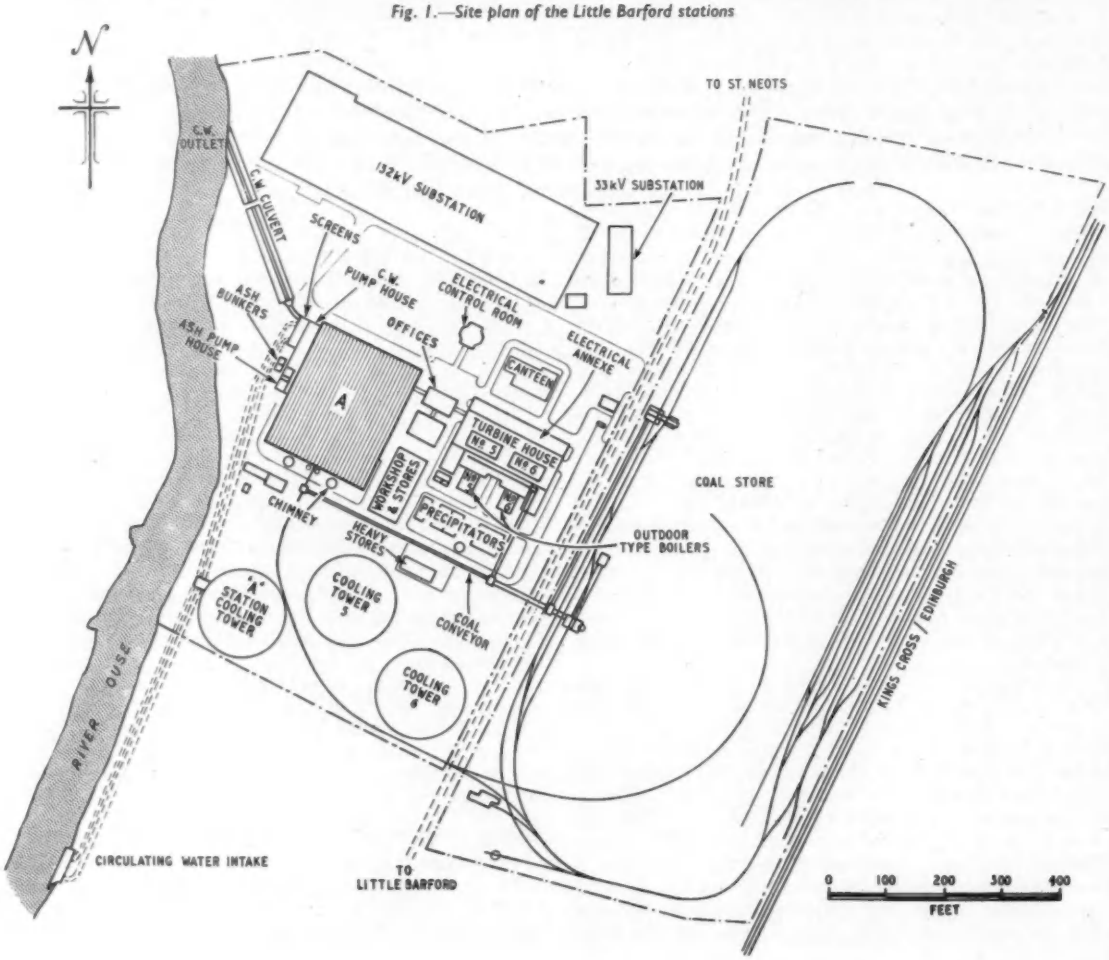
A simplified schematic of the whole control system is shown in Fig. 2. The scheme can be sub-divided into the following main groups:—

(1) Combustion control depending on steam pressure and air/steam flow ratio.

(2) Steam temperature control.

(3) Mill inlet control.

Fig. 1.—Site plan of the Little Barford stations



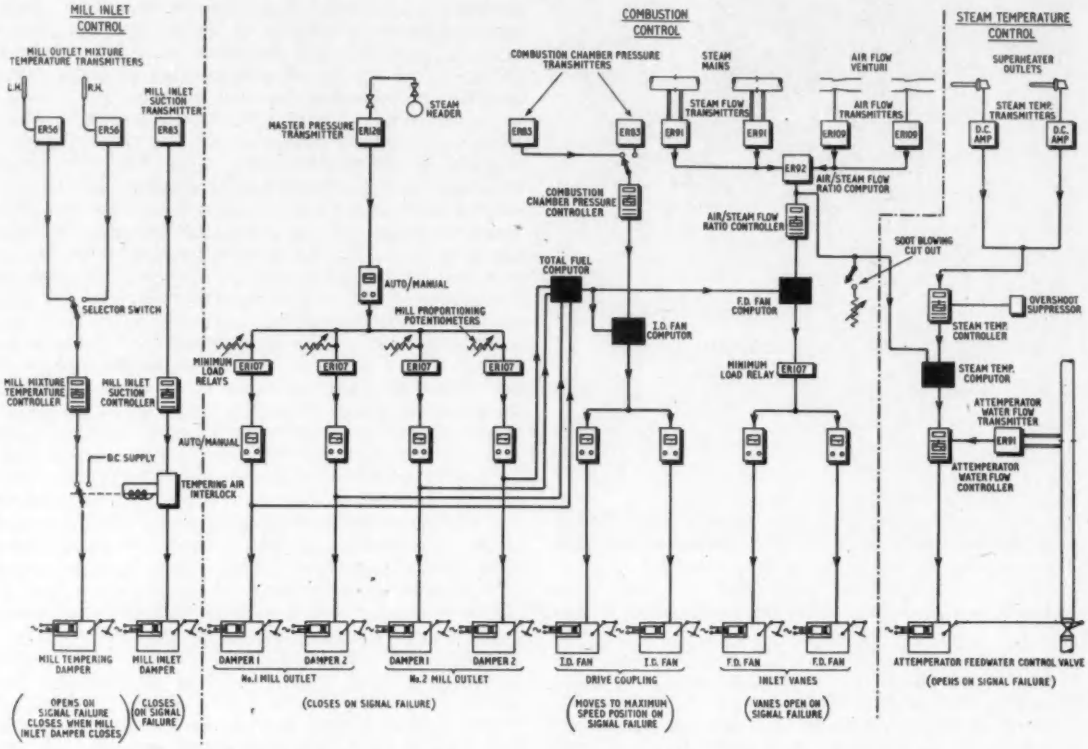


Fig. 2.—Simplified overall schematic of the Evershed electronic boiler control system. (Mill inlet control is shown for only one of the two mills per boiler. All dampers lock on control oil supply failure)

A master steam pressure transmitter type ER126 is provided and arranged to send out a 0 to 30 mA signal for a steam pressure change of 975 to 925 p.s.i., the current falling with an increase in pressure. The transmitter operates on a force balance principle. The pressure applied by condensate water in a small diameter pipe connected to the steam header is made to exert a force at one end of a beam which forms part of the transmitter. At the other end of the beam, a coil is affixed which operates in the field of a permanent magnet. The beam also carries a moving contact operating between two fixed contacts connected to a source of positive and negative bias respectively (see schematic diagram, Fig. 3).

The moving contact is connected to the grid of a thermionic valve contained in a power unit. Any deflection of the beam as a result of physical force applied, will thus modify the bias and thereby the current through the thermionic valve, which also passes through the coil. The force generated between magnet and coil is arranged to oppose the physical force derived from the steam pressure applied, so that when both forces are equal, the balancing current through the coil is established proportional to the physical quantity measured. Any indicators connected in series with valve and coil can therefore be calibrated directly in terms of the physical quantities concerned.

The transmitter consists of the beam assembly while the valve circuit is contained in the power unit. Power units for all transmitters at Little Barford are contained in cubicles in a room below the unit control room. Each power unit is in tray form which contains the h.t. rectifier, transformer, thermionic valve and all resistors and condensers. The complete circuit of a transmitter unit and power unit is referred to as the Evershed electronic repeater system. It is largely unaffected by wide variations in mains supply voltage and frequency and is independent of valve characteristics and line resistance. The value of the valve and coil circuit current is also independent of the number of meters connected in the circuit.

The signal from the master steam pressure transmitter is fed to an auto/manual control station. This consists of a manually-operated potentiometer, an auto/manual change-over switch, and input and output current indicators. When required to change from auto to manual control during, say, maintenance operations, the hand output indicator is adjusted by means of a potentiometer to the same value as the automatic output indicator at that time. The switch-over from auto to manual will thus be "bumpless" and will not interfere in any way with the performance of the plant. Under manual control, the signal from the transmitter is disconnected and substituted by the manual potentiometer output signal.

The output from the auto/manual control station passes to the input circuit of the minimum load relays via mill proportioning potentiometers. These potentiometers are inserted in the circuit to allow any desired load sharing by the p.f. mills. The minimum load relays are arranged so that their output current is approximately 15 per cent greater than the input current, thus, even if the latter falls to zero, the residual current will prevent the mills from shutting down completely. The output

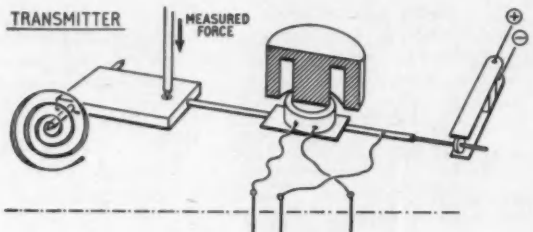


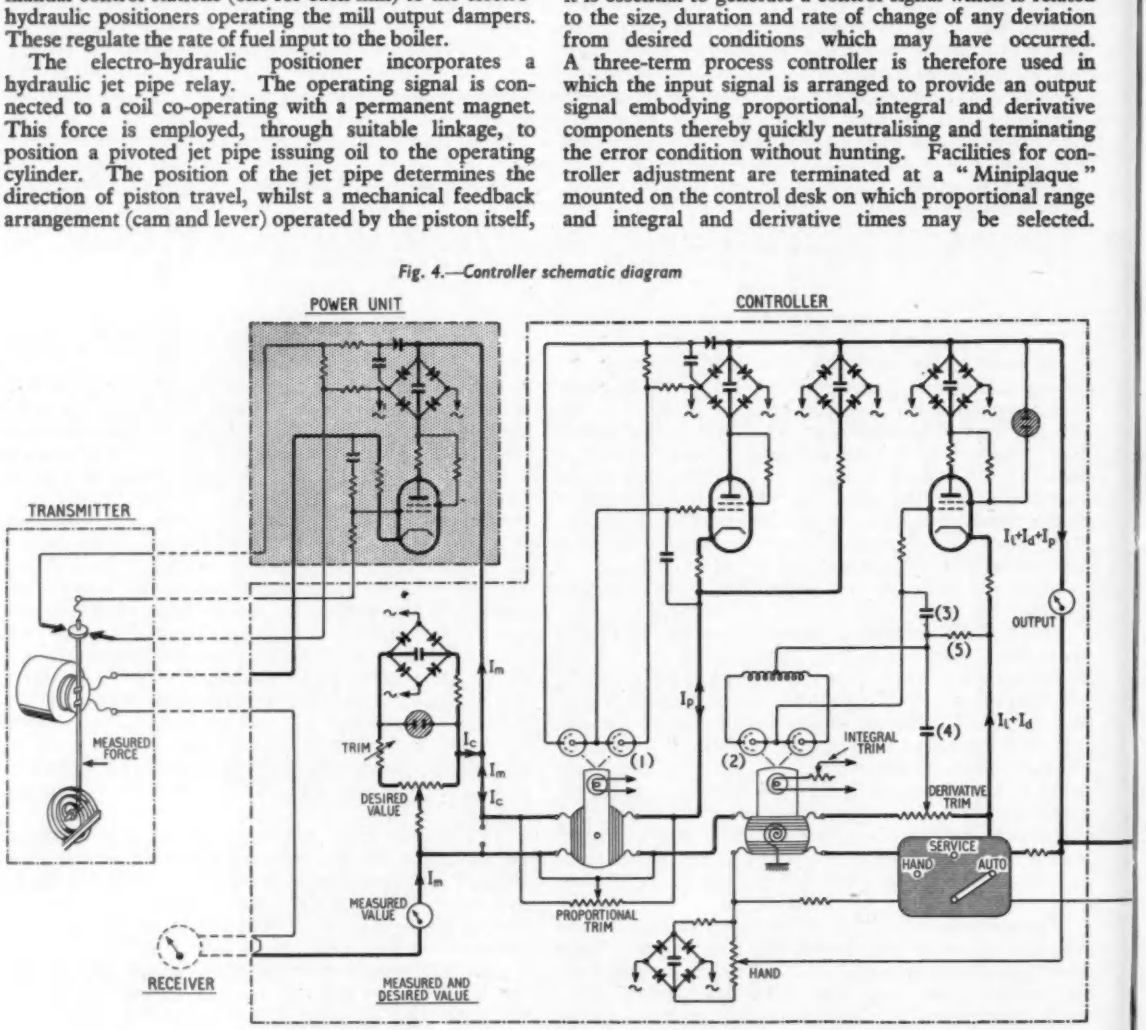
Fig. 3.—Transmitter/power-unit schematic diagram

current in the minimum load relays passes via auto/manual control stations (one for each mill) to the electro-hydraulic positioners operating the mill output dampers. These regulate the rate of fuel input to the boiler.

The electro-hydraulic positioner incorporates a hydraulic jet pipe relay. The operating signal is connected to a coil co-operating with a permanent magnet. This force is employed, through suitable linkage, to position a pivoted jet pipe issuing oil to the operating cylinder. The position of the jet pipe determines the direction of piston travel, whilst a mechanical feedback arrangement (cam and lever) operated by the piston itself, provides a balancing force when the positioner movement, analogue to the control signal, has been carried out. A hydraulic lock has been provided which, if failure of the control oil pressure due to either pump stopping, pipe breaking or other cause occurs, locks the oil in the cylinder and prevents it from moving. Under these conditions the positioner can be operated by hand through a switch-over facility on the side. Each positioner is self-contained with the unit, has its own electric motor driven control oil pump, and the case itself forms the sump for the control oil supply. The final signal to the mill outlet damper positioners is also fed to a total fuel computer which is interconnected with the combustion chamber pressure controller and the air/steam flow ratio controller.

Two type ER83 diaphragm pressure transmitters are provided to measure the depression in the furnace on two sides of the boiler. One of the output currents from these transmitters is selected to pass to the input circuit of the combustion chamber pressure controller. In the case of the mill damper positions, the position of these is directly proportional to the signal from the transmitters. In the case of the combustion chamber pressure, it is essential to generate a control signal which is related to the size, duration and rate of change of any deviation from desired conditions which may have occurred. A three-term process controller is therefore used in which the input signal is arranged to provide an output signal embodying proportional, integral and derivative components thereby quickly neutralising and terminating the error condition without hunting. Facilities for controller adjustment are terminated at a "Miniplaque" mounted on the control desk on which proportional range and integral and derivative times may be selected.

Fig. 4.—Controller schematic diagram

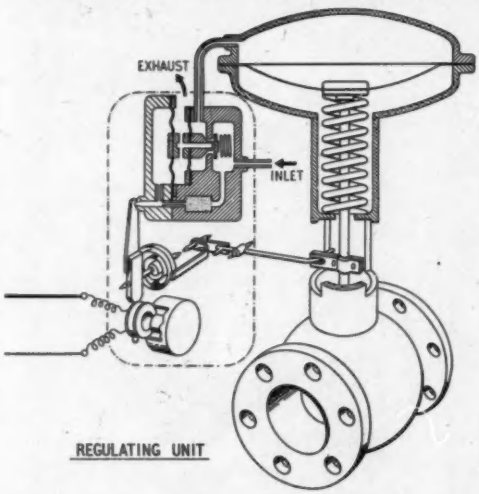


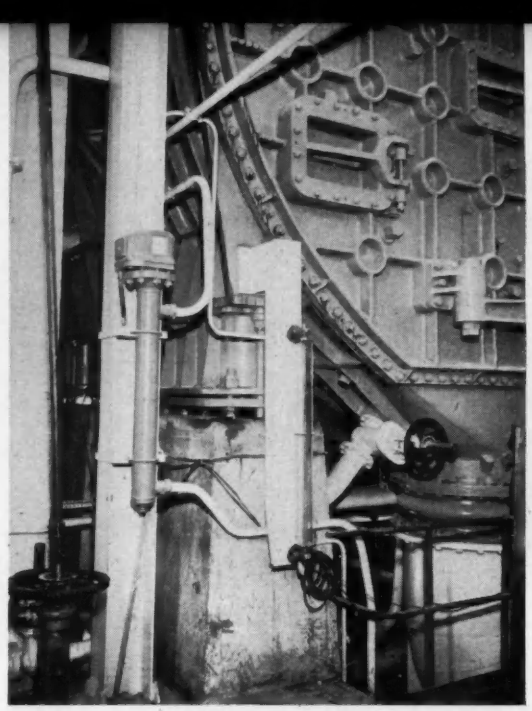
Measured value, desired value and controller output current are displayed and the "Miniplaque" also embodies "bumpless" transfer facilities from automatic to manual operation during maintenance.

The controller circuit can be divided into four sections: the measured value circuit, the desired value signal source, the proportional, integral and derivative control circuits, and the manual control circuit (Fig. 4). Where a transmitter is employed to provide a measured value signal for a process controller, the power requirements for the transmitter are generated by components contained in the controller, and identified above as the measured value circuit. The current through the valve (and thus through the transmitter coil) represents the measured value (Im) and is compared by a current representing the desired value (Ic) derived from a stabilised source (integral with the controller), and manually adjustable through a potentiometer. This comparison is accomplished by feeding Im and Ic in opposition into the same winding of the photo-electric relay (1). Should these currents be equal, that is the measured value equals the desired value, no movement of the relay will result. Basically, the relay consists of a light source mounted on the moving portion and two stationary photo-cells arranged so that the light is equally shared between them when the relay is balanced. When the coil currents are unequal, the light source moves and the signals from the two photo-cells become unbalanced. This error signal modifies the grid voltage of a valve whose anode current is fed back through the second coil of the movement in opposition to a fixed balancing current provided by a bridge rectifier. Thus, the current through the second moving coil is proportional to both direction and magnitude of the error.

The two coils of the photo-electric relay are shunted to provide a means of adjusting the sensitivity of the proportional band. The shunt is calibrated from 2 to 600 per cent.

The integral circuit is sensitive to the magnitude of the error and takes the form of a similar photo-electric relay (2) which is spring loaded so that the light is equally shared between the two photo-cells at zero coil current. Any error current from the proportional circuit passes through one coil of the relay and causes an unbalance of light and consequently a change in the emission of the photo-cells. These cells form two arms of a current bridge, and a capacitor (3) connected to the centre point becomes charged according to the magnitude and duration of the error. The rate of integration is determined by the light intensity and a variable resistor in the lamp circuit provides a means of calibration for an integration period of 0·2 to 60 minutes.





Water flow transmitter

The derivative action measures the rate of change of error and is achieved by a circuit formed by resistors and a capacitor. Whenever the error changes, a current flows from the centre point of the other arm of the photo-cell current bridge already mentioned. This current modifies the charge of a capacitor (4) and the voltage drop at the resistor (5) is a measure of the rate of change of error over a time period determined by the value of another resistor in series with the capacitor. This resistor allows a derivative action time range of 0 to 10 minutes.

The voltages appearing across the resistor (5) and the capacitor (3) are applied to the grid of the thermionic valve and the resulting valve current represents the derivative and integral components (Ii+Id). This is added to the proportional current (Ip) to give a three-term electrical output in the range 0 to 30 mA d.c.

As previously mentioned, a signal from one of the diaphragm pressure transmitters in the boiler furnace is passed to an Evershed three-term controller. The output signal of the controller is fed into the i.d. fan computer and, via auto/manual control stations, to the electro-hydraulic positioners regulating the couplings on the i.d. fan. The i.d. fan computer receives a signal from the total fuel computer as well as from the combustion chamber pressure controller. The output signal from the total fuel computer represents the sum of the control currents applied to the electro-hydraulic positioners of the four mill outlet dampers. If the rate of fuel input is proportional to the opening of the mill outlet dampers, this summated current is then proportional to the total rate of fuel flow. The i.d. fan computer therefore receives a signal proportional to the total rate of fuel flow (M) and a three-term error signal determined by the combustion chamber pressure (C). The i.d. fan computer operates on these two signals according to:—

$$\text{Output of i.d. fan computer} = \frac{M}{2} + 2C$$

Unit control room with Evershed electronic boiler control apparatus

The total fuel and the i.d. fan computers referred to are Evershed & Vignoles type ER92. These are simple analogue computers and their operation is based on a centre pivoted beam carrying coils at each end. The arrangement of the coils depends upon the equations to be solved. Signals representing the variables are fed into all but one of the coils, this coil being connected to a power unit. Displacement of the beam from its balance position results in a change in the grid voltage of the thermionic valve in the same way as previously described for the transmitter. The change in anode current is fed back to restore the beam balance and the value of the valve current is the solution of the equation. A schematic diagram representing a general computer is shown in Fig. 5.

In operation, the i.d. fan computer allows the i.d. fan vanes to be positioned in relation to the amount of fuel entering the boiler. This position is then trimmed by the combustion chamber pressure control to restore the pressure to the required value. The i.d. fan drive coupling positioners are arranged so that on a failure of control signal the couplings move to maximum speed.

The output signal from the total fuel computer is also fed to the f.d. fan computer, which is in the air/steam flow control subsection. Two steam flow transmitters, type ER91, are provided, one for each of the steam outlet mains, and are arranged to send out a current of 0 to 15 mA proportional to a change in steam flow of 0 to 325,000 lb/hr. These two currents are summated by connecting the positive and negative terminals in their output circuits and the result is fed into one coil of the air/steam flow ratio computer. The other coil of this computer receives the sum of the output currents from two air flow transmitters, type ER109, measuring air flow in terms of differential across the venturis installed in the inlet ducts of the two f.d. fans. The air/steam ratio computer operates on these two input signals according to the following equation:—

$$\text{Output of air/steam ratio computer} = 15\left(\frac{A-K}{S}\right)$$

where A is the summated air flow current, S is the summated steam flow current and K is a constant fed from the d.c. source.

The output current from the air/steam flow ratio computer is fed into the air/steam flow ratio three-term controller, which in turn feeds the f.d. fan computer. This computer also receives a signal from the total fuel computer and operates on the following equation:—

$$\text{Output of f.d. fan computer} = \frac{M}{2} + 2F$$

where M is the output of the total fuel computer and F is the output from the air/steam flow ratio controller. The output of this computer is fed via a minimum load relay and then through auto/manual control stations to the electro-hydraulic positioners regulating the inlet vanes of the f.d. fans. These maintain the air/steam ratio to the value set by the controller.

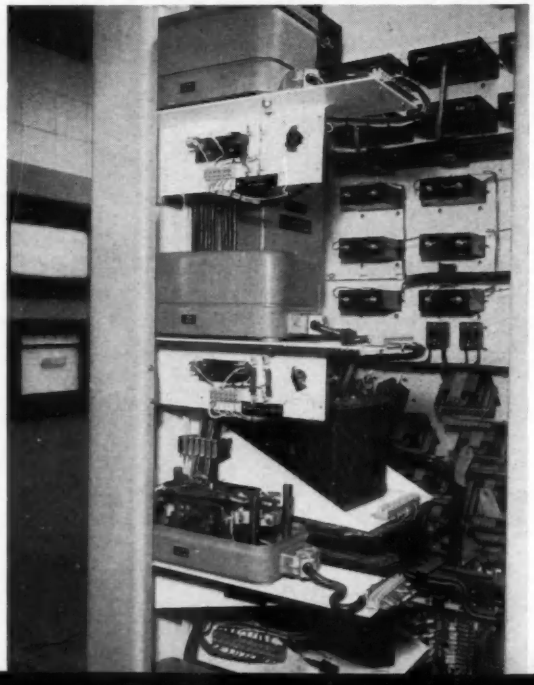
Thus the resultant operation of the f.d. fan positioners is as follows. On a changing load, the output current sent out by the total fuel computer roughly positions the f.d. fan inlet vanes and this position is then trimmed by the air/steam ratio controller to restore the ratio to the required value at the new load. The minimum load relay is arranged to send out a control signal which ensures that the positioner never completely closes the fan vanes even if the actual controller output signal reaches the maximum 15 mA level.

Steam Temperature Control

The output signal from the air/steam flow ratio computer is also fed into the steam temperature computer. Two steam temperature transmitters are provided which consist of a thermocouple installed in the two outlet steam mains, and a subsequent d.c. amplifier which translates the small potential generated in the thermocouples into a signal suitable for use in the input circuit of a controller. The amplifier makes use of a thyratron controlled by a galvanometer/photo-cell arrangement. The currents sent out by these transmitters are summated and passed to the input circuit of the three-term steam temperature controller. To suppress any tendency to overshoot in coming up to load, the controller is provided with an integral limiting relay which ensures that the integral term of the controller does not become saturated.

The output current from the steam temperature controller is passed to the coil of the steam temperature computer, the other coil of which receives an output

Part of the rear of the main control panel showing a computer (lower) with the lid removed



from the air/steam flow ratio computer. The equation of the computer is:—

Output of steam temperature computer = T + (A − 15)

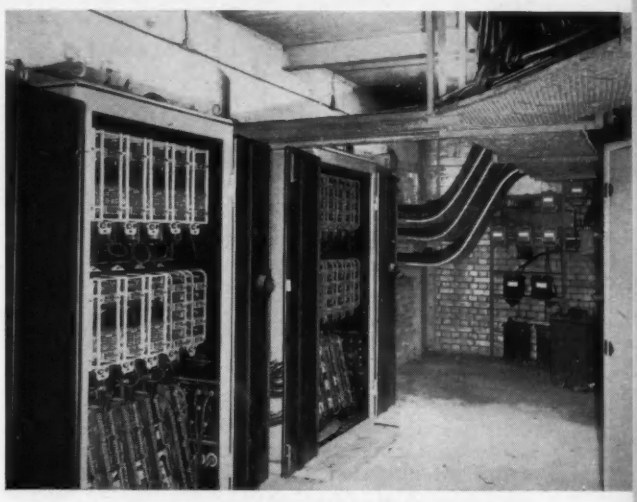
where T is the output from the steam temperature controller and A is the output from the air/steam flow ratio computer.

The output current from the steam temperature computer is received by the attemperator water flow controller. As already mentioned, the final steam temperature control is effected by means of a hollow tube surface condenser where the dryness fraction of the saturated steam entering the primary superheater is varied. The normal hot feed water flows through the centre of the surface condenser and steam to the primary superheater flows around this tube. The output from the controller operates the electro-hydraulic positioner regulating the opening of the attemperator feed water control valve.

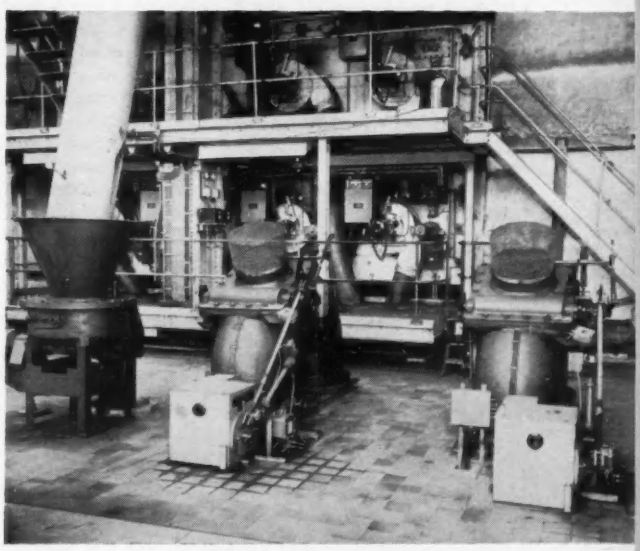
On a reduction in boiler load, the current from the air/steam ratio computer falls and, through the steam temperature computer, demands an increase in attemperator water flow. After a short delay, the steam temperature starts to rise slightly and the steam temperature controller output then also demands an increase in attemperator water flow. The air/steam ratio during this period tends to be restored to its previous value under the action of the air/steam ratio controller. The settings of the steam temperature controller and the steam temperature computer are such that, as the output from the air/steam ratio computer reverts to its normal figure, the output from the steam temperature controller rises so that the attemperator water flow remains at the increased value demanded by the change in air/steam ratio.

To prevent hunting between the main feed water valve and the attemperator valve (which is operated by the electro-hydraulic positioners), an attemperator water flow transmitter resets the terminals of the attemperator water flow controller.

To prevent undesirable fluctuations in the steam temperature control during operation of the Hopkinsons soot blowers, a soot blowing cut-out relay is incorporated before the steam temperature computer in the output of the air/steam flow ratio computer. During soot blowing, the signal from the air/steam flow ratio computer will be disconnected and the corresponding coil of the steam temperature computer will be short-circuited. With this refinement, there will be no sudden change in feed water flow or any disturbance to the steam/air flow ratio control system.



Part of the equipment in the power unit room below the main control room



Boiler firing aisle showing Evershed electro-hydraulic positioners in the foreground

Mill Control System

A type ER83 diaphragm pressure transmitter is connected to a tapping point in the mill suction duct. The output from this transmitter is proportional to the inlet depression. The output of the transmitter passes to the input circuit of the three-term mill inlet suction controller, which in turn passes a signal to the electro-hydraulic positioner regulating the mill inlet damper. The mill inlet damper positioner is arranged so that on failure of control signal the positioner closes the damper.

A temperature transmitter, type ER56, is provided on each of the two outlet ducts from each mill and produces a signal proportional to the temperature in the duct. A signal from one of these transmitters is selected to pass to the input circuit of the mill mixture temperature controller, the output of which is fed via an electrical relay to the electro-hydraulic positioner to regulate the attempering air damper to maintain the mill mixture temperature at the required value. The electro-hydraulic positioner is arranged to open the damper on failure of the control signal. The electric relay in the control line to the mill inlet positioner is arranged so that when the control current to the mill inlet damper falls below a certain value, this relay is energised, disconnects the mill mixture temperature controller and passes a suitable d.c. signal to the electro-hydraulic positioner operating the mill temperature or damper. This causes this damper to be closed.

From the above description of the operation of the Evershed integrated automatic electronic boiler control system, it will be appreciated that the system is very flexible due to the numerous operations carried out on the control signals by the computers and three-term controllers and the interconnection of these signals in the overall scheme.

A dry ash and dust plant has also been installed at this

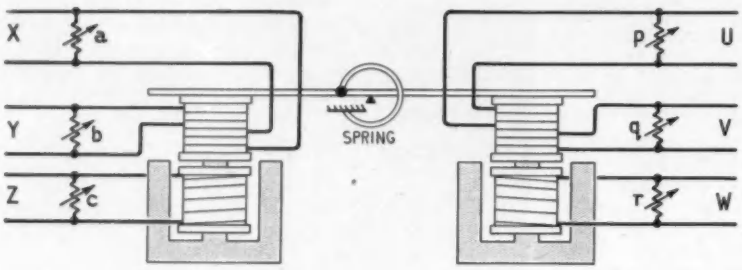


Fig. 5.—Principle of the computer. The beam also carries a biasing contact which is connected to the power unit

The equation for this computer is
$(ax \pm by)cz \pm S + (pu \pm qv)rw = 0$
where a b c p q and r are adjustable coefficients, x y and z are variables, any one of which can be the output, and S is the spring torque

station and is similar to that at Bold "B" which was described in the *Electrical Review* of 11th September.

Turbines

The two Parsons turbo-alternators are designed to have an electrical output of 60 MW for both maximum and economic continuous rating with steam conditions before the turbine stop valve of 900 p.s.i. and 900°F. The turbines are of the two-cylinder impulse reaction type and run at a normal speed of 3,000 r.p.m. Steam is bled for five stages of feed heating, giving a designed final feed temperature of 385°F. At a load of 60 MW and a vacuum of 28·7in Hg, the guaranteed steam and heat consumptions are 8·4767 lb/kWh and 9,256·9 B.Th.U./kWh.

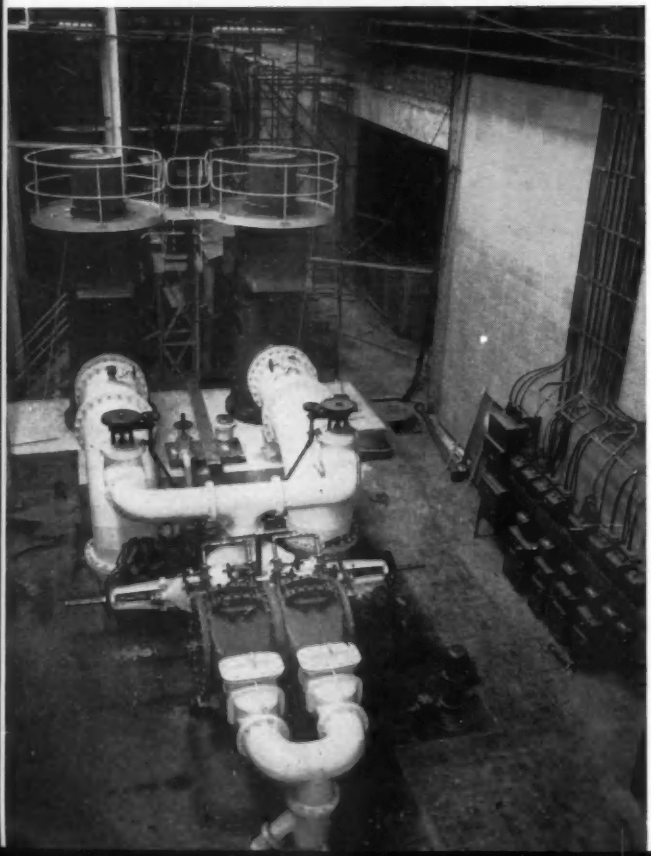
Extensive turbine instrumentation has also been supplied by Evershed & Vignoles, but the various items are not integrated into an overall control scheme. One arrangement, however, is of particular interest as it provides a measurement of the temperature of the turbine rotor by relating this temperature to variations in the rotor resistance. The equation involved is solved by a simple computer, one of the windings of which receives its input signal via a saturable reactor, which, in turn, is effectively connected across the rotor brushes.

The two natural draught concrete cooling towers installed by Yorkshire Hennebique are rated at 2·55 m.g.h. and are 226ft high. There are no valves in the c.w. system, since each tower is included in the turbo-alternator/boiler unit system. The circulating water is supplied to the condensers from the cooling towers in separate culverts for each unit. The c.w. pumps, which have been supplied by Vickers-Armstrongs, are unusual in that the pitch of the impellers can be varied.

The Parsons alternators are rated at 60 MW at 0·8 power factor and generate at 11·8 kV. They are cooled by hydrogen at a pressure of 15 p.s.i. Four gas coolers are mounted in the upper half of the stator casing. Each alternator is directly connected to a 72 MVA, 11·8/132 kV Parsons generator transformer. Both the turbo-alternator/boiler units are operated from a single control room situated between the turbines and boilers. The station electrical control room is situated in the combined "A" and "B" station building where all loading and switching operations are carried out.

Acknowledgment is due to the staff of the Southern Project Group, Central Electricity Generating Board, and to Evershed & Vignoles, Ltd., for collaboration in the preparation of this article and to the chief project engineer of the Southern Project Group, Mr. T. Yule, for permission to publish the article.

Vickers-Armstrongs variable pitch circulating water pumps. Evershed electro-hydraulic positioners are contained under the cover on the top platform



Coast Radio Jubilee

WHEN the Post Office started its marine radio communication system in 1909 with a nucleus of eight stations purchased from the Marconi Co. and Lloyd's, there were only 286 British ships equipped for radio communication and the small staff of the stations dealt with some 50,000 messages a year. Today 850,000 messages are handled through the shore link with 6,300 British and 3,000 foreign ships. The medium-range radio-telephony service is mainly for crews of ships up to 250 miles from the coast of Britain, though this will be extended shortly to a passenger service which will provide radio-telephone calls at special rates when a ship is about 250 miles from the coast. To free some of the medium wavelengths during peak periods the Post Office has installed v.h.f. stations at Clyde, Niton and North Foreland so that traffic within 40-60 miles of these stations can be handled with the minimum delay.

From the International Telephone Exchange in London a long-range ships' telephone service is provided for ships anywhere on the seven seas and, in addition, Burnham Radio operates an area scheme for long-distance radio-telegraph work to Commonwealth ships. One of the important uses of coast radio is the distress service given free to ships of all nations, a constant alert being kept to enable immediate help to be rendered.

VIEWS on the NEWS

By REFLECTOR

SOME people in the industry think that the public are mystified by the terms which come trippingly on the tongues of electrical men. It is true that the lay Press seems incapable of distinguishing between kilowatts and kilowatt-hours, but I think that most people are becoming accustomed to common electrical usage. I suppose that it is still desirable to refer to "units" rather than kWh, although this arrogation of a general term by electricity is a quaint survival. Who now remembers that they are really "Board of Trade units" and why? So accepted is the kilowatt nowadays that the sellers of domestic oil heaters rate their appliances in terms of kilowatt equivalents, or sometimes as being equal to "two-bar electric fires." Of course, the megawatt is still rather strange; I have even found electrical men averse to its use. Certainly power station ratings are more impressive if they are stated in kilowatts, and more so if they are reduced (or increased) to watts in the manner adopted by some daily papers.

* * *

As a postscript to the foregoing I quote a report from the *Star*:—

> "Plans have been discussed in Oslo for the building of the 6,000,000,000 kilowatt Sira-Kvina electric power plant, which, when completed, will be the biggest in Northern Europe."

* * *

The standardisation of electricity supply in this country is by no means completed. For instance, in the area of the Midlands Electricity Board there remains a 200 V supply in parts of South Staffordshire and North Worcestershire formerly served by the Midland Electric Corporation. According to a report in the *Express and Star* (Wolverhampton) some 78,000 domestic and small commercial consumers are to be changed over at a cost of £2·8 million and "at the rate of about 60 conversations a day." I hope the talk does not interfere too much with the work.

* * *

A couple of weeks ago I suggested that there was a need for a floor standard with some form of control to vary the illumination for different purposes. What I had in mind was some form of dimming device, but a standard produced by Messrs. Troughton & Young (Lighting), Ltd., to which my attention has been drawn, should be a satisfactory alternative. This has separately switched direct and indirect heads with an interior reflector. The indirect head embodies a 150 W (max.) lamp and is suitable for use while television is on, and the direct head, with two 60 W (max.) lamps, can be used for reading purposes, etc. So far I have not heard from any manufacturers of kettles with a secondary element to keep the water on the boil when it has been raised to boiling point, which was another suggested need.

* * *

In the course of an article in the 25th September issue of the *Electrical Review* on "Electronics Applied to Industrial Instrumentation" the author (Mr. N. J. Day) referred to industrial electronic devices for detecting the presence of ferrous or non-ferrous metals. The Editors have shown me a letter from an Indian firm which would like one of these detectors for a purpose which I am sure the author hadn't thought of. This firm suffers from the theft of small tools and what it wants is equipment which would cause a bell to ring when anybody with metal on him passed through a small wooden wicket gate. It seems to me that the examiners on the gate would be in for a busy time unless the apparatus could be made to distinguish between small tools and other metal objects commonly found in people's pockets. Nevertheless, I consider this to be a good example of the way in which the *Review* interests all kinds of people—even this (non-electrical) Indian concern.

* * *

"Don't do it Yourself if it's Electrical, City Engineers Advised" was a recent headline in the *Nottingham Evening News*. In the ordinary way this advice would have been very sound, but the "city engineers" in question were members of the Nottingham Branch of the Association of Supervising Electrical Engineers. The advice was given by Mr. S. J. Emerson, Chief Electrical Inspector of Factories, but I am sure that he excepted the members of his audience from his injunction.

* * *

The leading article in the *Electrical Review* of 15th November, 1879, took the form of an eulogism of James Clerk Maxwell who had died a few days earlier. It was rightly said that electrical science had sustained a severe loss in the premature death of Clerk Maxwell (who was only 48) and that his great work on electricity might be called the *Principia* of the subject of which it treated; it had carried his fame into all civilised countries. A point of particular interest is that the Cavendish Laboratory at Cambridge University was established largely to enable Clerk Maxwell to develop his work as the first Professor of Experimental Physics. Special mention was made of his talent for the clear exposition of his ideas. "His style was singularly lucid, terse, and yet polished, it was in short the perfection of a purely scientific style; and his superabundant wit and humour occasionally burst from the restraints of severer thought and found vent in the more liberal forms of poetry."

Semiconductor Production

A high rate of production is being achieved at the semiconductor factory of the General Electric Co., Ltd., at Hazel Grove, Stockport. This is combined with a very low reject rate. A wide range of types of semiconductor devices are produced

LAST week we visited the Hazel Grove, Stockport, factory of the Semiconductor Division of the General Electric Co., Ltd., and inspected the plant and equipment which is now producing about 70,000 transistors and diodes every week. Another 50,000 diodes per week are manufactured at the G.E.C. Radio Works, Coventry. All these devices are marketed through the divisional headquarters at Hazel Grove. During our visit we were interested to learn that as a result of employing manufacturing techniques exclusive to the company, an average yield of semiconductor devices of between 70 and 80 per cent has been achieved with the yield on one device as high as 90 per cent. The company believes that these results are better than those of any if its British competitors.

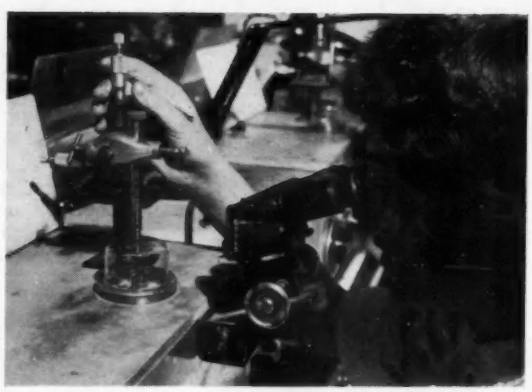
Over 100 types of semiconductor devices are made at Hazel Grove. This is the widest range of semiconductors produced in Britain and includes low power audio frequency, radio frequency and power transistors; low power silicon junction diodes; and medium power silicon junction, diffused junction silicon, and germanium junction rectifiers. In addition, about 30 types of radar mixers and point contact signal diodes are manufactured at Coventry.

The development and production resources of the G.E.C. have been engaged on semiconductor devices since their inception, from the early " cat's whisker " crystals of the 1920's to the latest high frequency transistors. During the war hundreds of thousands of silicon crystal diodes were made for use at very high frequencies in radar and telecommunications equipment and the G.E.C. has always been a leader in the coaxial crystal field. In 1945 a plant was set up at Wembley for the production of germanium crystals suitable for use in semiconductor devices, and shortly afterwards factory production of germanium point-contact signal diodes started at Coventry. The company's CV.448 diode has long been the accepted " standard " in the industry.

In 1952 new laboratories were opened at Wembley to accommodate the expanding research on semiconductors, but it was not until April, 1956, that the factory at Hazel Grove became available. In 1958 the Semiconductor Division was formed to " streamline " and simplify sales and production arrangements by bringing the customer into direct contact with the producing factories.

Although the bulk of manufacture takes place at Hazel Grove the germanium and silicon crystals are grown at Wembley by a unit responsible to the production manager at Hazel Grove. On arrival at the factory the crystals are sawn into thin wafers and then " diced " into the required

Alloying silicon junction diodes



Removing a 5 kg single crystal of germanium from the equipment in which it has been grown at the Wembley Research Laboratories. It is now ready to be sliced for use in transistor manufacture

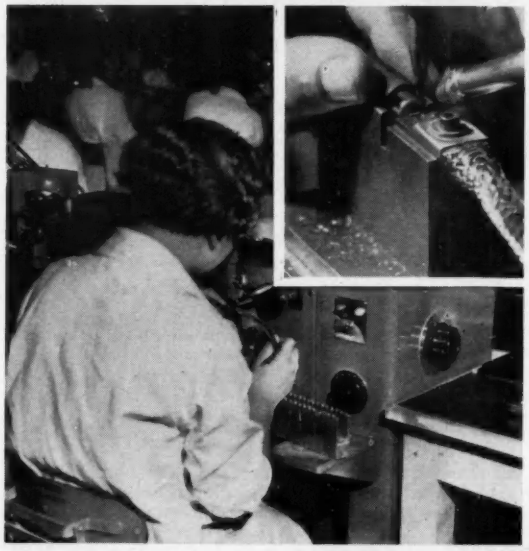
size for the various semiconductor devices. A new method of crystal dicing is now beginning to replace the saw-cut technique, however. This is called diamond scribing and it is twelve times faster than the saw-cut method and is much less wasteful of semiconductor material. Another interesting item we saw was an automatic crystal measuring machine which has been developed by the company to deal with 1,200 wafers an hour, sorting them into batches according to thickness for different furnace temperatures. The thickness varies between 0·0025 and 0·004in for the audio transistor production lines.

Glass-to-Metal Sealing Process

In another part of the manufacturing process a technique exclusive to the G.E.C. is used to ensure the maximum efficiency of the glass-to-metal sealing process. The main item of equipment employed here is a centrifuge, which was developed at the Wembley research laboratories. It consists of a rotating annular shaped boat and fitted lid which is enclosed in a firebrick enclosure. The boat, which is flushed with an inert gas and heated by a bank of gas jets, is situated within the enclosure. The method of operation, once the components have been assembled and jigged and placed radially in the boat, is completely automatic.

The cycle is started by setting the speed of rotation to the required level. The brick lid automatically descends to enclose the rotating boat and triggers the gas/air supply which heats the boat and its contents to a preset temperature. The temperature is controlled for a given period after which the gas is turned off and forced air cooling under controlled conditions effects the annealing of the seals which are still in the inert atmosphere. A further period of uncontrolled cooling reduces the boat and its contents to handling temperature.

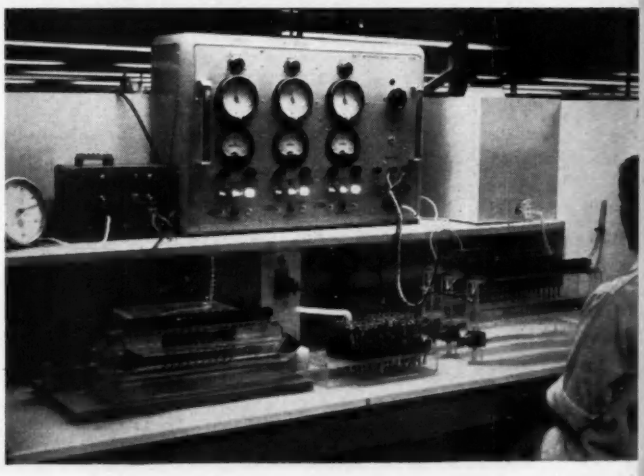
The final hermetic sealing of the transistor envelopes is carried out by cold welding. The application of the process to transistors was a G.E.C. invention and has since

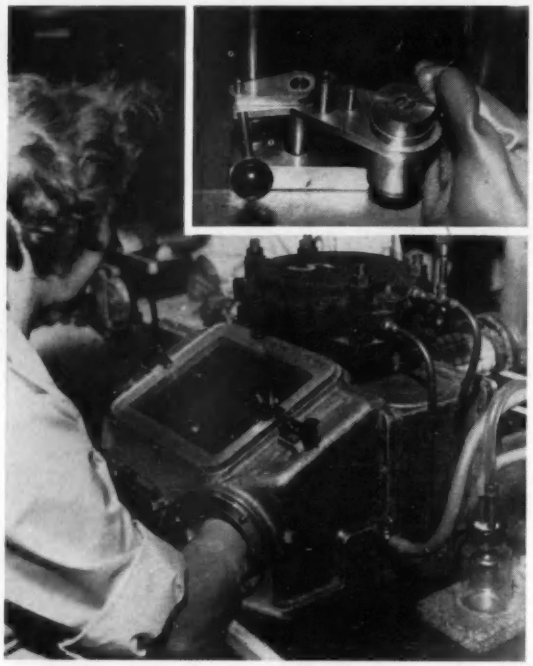


Spot welding of silicon junction diodes. The actual diode, consisting of the minute silicon wafer and its gold and aluminium lead wires, is spot welded to its mount

This machine sorts 1,200 germanium and silicon wafers per hour according to thickness for use on various semiconductor devices

Apparatus for the electrolytic etch cleaning of power transistors after alloying





Cold welding audio transistor cans. The device is sealed in an inert atmosphere by the application of a pressure of 90 p.s.i. alone. This gives a permanent hermetic seal without damaging or contaminating the device

been adopted by many other, including some American, companies. The surfaces of the metals to be joined must be cleaned before compression between dies to give a welded joint. The surface films remaining after cleaning are dispersed by the controlled lateral flow of the mating surfaces and contact under pressure is obtained between perfectly clean metals. In this way a true homogeneous weld is obtained without the necessity for the application of heat.

In a cold welded joint the metal is truly continuous across the weld. The electrical and thermal conductivities of the joint are therefore equal to those of the parent metal. Cold welded joints are thus particularly suitable for the hermetic sealing of semiconductors, the absence of heat, solder, flux vapour, weld flash or gas flames ensuring that there is no damage to, or contamination of, the device during the sealing process. This is a basic requirement for long life stability.

At the Hazel Grove factory some 200,000 gal of water a week, to be increased to 500,000 gal by 1961 to cope with rapidly increasing production, is used for cleaning after the etching and acid dipping processes. Liquid nitrogen is used at the rate of 80,000 cu ft per week, and hydrogen for the alloying furnaces at 12,000 cu ft. Over 20,000 cu ft of forming gas, consisting of 85 per cent nitrogen and 15 per cent hydrogen, is used for furnacing every week.

The factory provides employment for 700 people, one half of whom are women working in the main assembly shop. Production, in fact, accounts for some 400 people, the remainder being equally divided between administration, development and engineering. The factory covers a floor area of 72,000 sq ft of which nearly 16,000 sq ft is taken up by the main assembly shop.

Mersey and North Wales Centre Dinner

THE annual dinner of the Mersey and North Wales Centre of the Institution of Electrical Engineers was held at the Grosvenor Hotel, Chester, last week under the chairmanship of Mr. T. A. P. Colledge. As usual there was a very good attendance and after the chairman had proposed the loyal toast, Dr. Charles Evans, principal, University College of North Wales, Bangor, the distinguished mountaineer, proposed a toast to the Institution. He spoke of the close connection which was being built up between his university and the I.E.E. and said that they valued this very much and found the library facilities which were thereby made available particularly useful.

He referred to the climbing of Everest and the contribution to this achievement which was made by the electrical industry, largely in the field of communications. Electricity had increased the effectiveness and scope of activities in almost every sphere. He passed on to refer to his other profession, surgery. Once or twice he had performed operations by candle-light or hurricane lamp. The electrical industry had done much to advance surgery by providing adequate operating theatre lighting. In another connection great changes had been brought about in brain surgery by the introduction of electrical means of cauterising.

The response was made by Sir Willis Jackson, President of the Institution, who said that he had recently opened a new electronic engineering building at Bangor University. He referred also to the good work which was being done by the large manufacturers in providing training schemes and said that there was a very definite place in this connection for the smaller, more specialised, firms. This point had been raised before but very little had been done by the smaller companies either on their own or by groups as had been done in Scotland. Finally, Sir Willis said that only 30 per cent of the membership of the I.E.E. contributed to the Benevolent Fund and he appealed for better support.

Two witty speeches followed, Professor J. M. Meek, past-chairman, proposing a toast to the guests and the Rev. L. F. Harvey, headmaster, King's School, Chester, responding.

Left to right: Dr. G. Ellison (Bishop of Chester); Professor J. M. Meek (past-chairman of the Centre); Sir Willis Jackson (President, I.E.E.); Alderman H. W. Talbott (Mayor of Chester); Mr. T. A. P. Colledge (Centre chairman); Rev. L. F. Harvey (headmaster, King's School, Chester); and Mr. S. Towill (hon. secretary of the Centre)

Comparative Study of Kaplan and Deriaz Turbines

By P. DERIAZ, Dip.Mech.Eng.(Zürich)*

The Deriaz turbine was developed to provide a machine operating under heads in excess of 200ft which would have the flat efficiency/load characteristic as well as the part-gate stability of operation of the familiar Kaplan turbine. For heads in excess of 120ft the mixed-flow Deriaz turbine has marked advantages over the axial-flow Kaplan machine. To illustrate the various factors involved the author sets out the results of a recent study made to compare the two types for a specific installation

IT is well known that at heads above 200ft the application of the Kaplan turbine becomes extremely difficult, both hydraulically and mechanically. To provide a turbine, operating under heads in excess of 200ft, which would have the flat efficiency/load characteristic as well as the part-gate stability of operation of the Kaplan, the mixed-flow Deriaz turbine with a variable-pitch-blade runner has been developed.[1]

The first application of the new design was at the Sir Adam Beck, Niagara, pumping-generating station of the Hydro-Electric Power Commission of Ontario, where the units are required to run both as pumps and turbines.[2] Six machines are installed with a total pumping capacity of 300,000 h.p. (Fig. 1). At present, three Deriaz turbines of 110,000 h.p. each are being designed for a Spanish power station and these also will run in reverse as pumps (Fig. 2).

The author finds, as a result of detailed study, that for heads in excess of 120ft the mixed-flow Deriaz turbine has marked advantages over the axial-flow Kaplan turbine. With heads lower than 120ft the higher speed of the Kaplan and consequent cheaper generator are predominating features in favour of the Kaplan. To illustrate the advantages of the Deriaz machine, this article sets out the results of the study made recently to compare a Deriaz turbine with a Kaplan for a specific installation. The design data are the same for both machines, as follows:—Output 30,000 h.p.; head 18oft; speed 300 r.p.m.; specific speed $n_s = 350$ (metric). The cross-sectional arrangements of the two designs are shown in Figs. 3 and 4. Both machines have the same guide-vane pitch circle diameter, although the Kaplan has a somewhat larger gate height. In this design the axis of the blades on the Deriaz machine (Fig. 3) are inclined at 30° to the horizontal, which differs from the 45° hitherto adopted at Niagara (Fig. 1). This is in order to suit a higher specific speed for this particular turbine.

Hydraulic Considerations

We shall now consider the relative merits of the two alternative designs shown in Figs. 3 and 4 from the hydraulic and mechanical points of view. In comparing the hydraulic profiles of Figs. 3 and 4 it will be noticed that the one in Fig. 3 is better streamlined, and offers a more direct passage from the gate apparatus to the draft tube. Because the runner hub in Fig. 3 is much shorter than that in Fig. 4 the wetted perimeter is reduced, and a reduction in friction losses results.

The head of 18oft, which is high for the Kaplan, calls

* Chief Designer, Water Turbine Department, English Electric Co., Ltd.

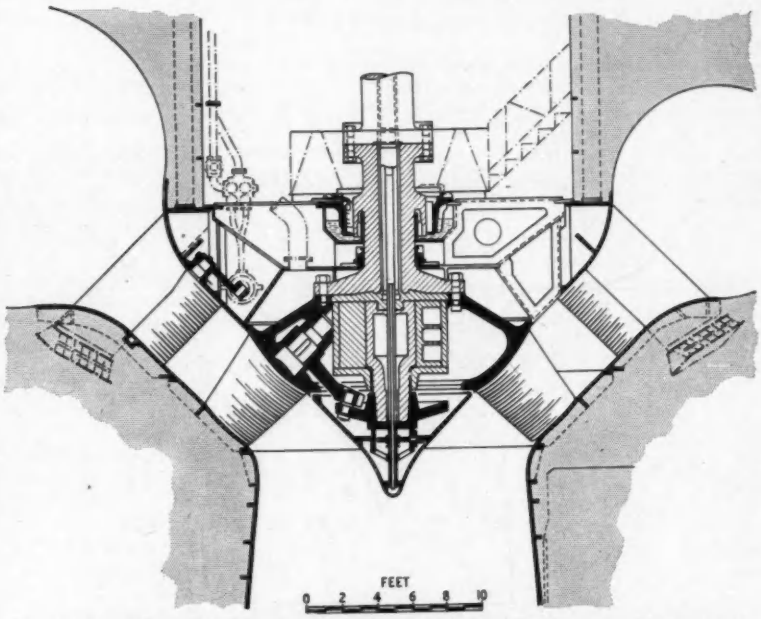


Fig. 1.—Reversible pump-turbines for the Sir Adam Beck, Niagara, pumping-generating station of the Hydro-Electric Power Commission of Ontario

Turbine output 46,000 b.h.p. Pump input 52,500 b.h.p. Speed 92·4 r.p.m. Head 40 to 90ft

for a relatively low specific speed. The radial extent of the blade ΔR_1 should accordingly be small. This is readily achieved on the Deriaz design without an increase in the water velocities because the mean radius at blade entrance is larger.

In the case under consideration the radial extent ΔR_1 of the blade on the Deriaz machine is 8 per cent smaller than on the Kaplan. It should also be noted that while both designs have the same runner outlet area, the inlet area on the Deriaz machine is 27 per cent larger than on the Kaplan. Low inlet water velocities are thus achieved.

Inlet and outlet velocity triangles for the mean blade section are shown for both Deriaz and Kaplan designs in Fig. 5. The increased inlet peripheral speed u_1 of the Deriaz combined with reduced inlet water velocity c_1 make the inlet and outlet relative velocity vectors w_1 and w_2 almost parallel, that is, the inlet and outlet blade angles β_1 and β_2 are the same. For the Kaplan w_1 and w_2 are divergent, as the triangles show, $\beta_2 < \beta_1$. When the blade is rotated, the inlet blade angles change simultaneously by the same amount. Therefore on the Deriaz they remain parallel, while on the Kaplan they remain divergent. As the flow conditions require that both β_1 and β_2 tend to zero when the flow reduces to zero, the Deriaz runner remains in accordance with the hydraulic requirements at all blade angles. This results in a higher efficiency than the Kaplan at very reduced loads.

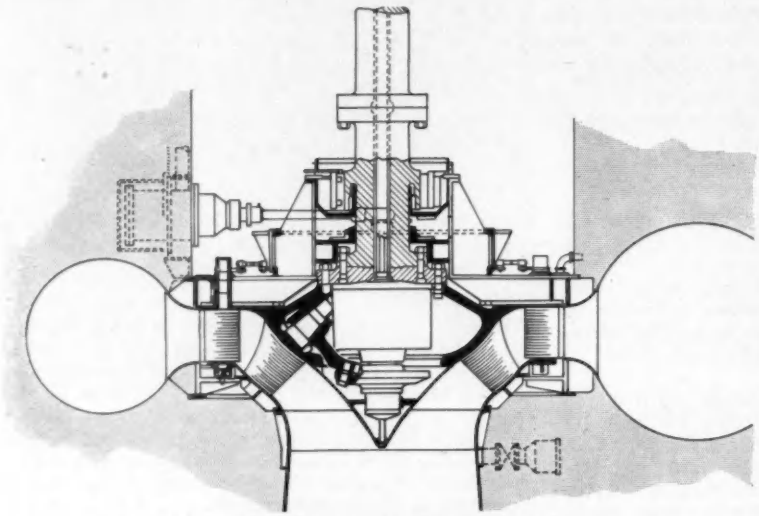


Fig. 2.—Reversible pump-turbines for Valdecanas, Spain

Turbine output 110,000 b.h.p. Head 240ft. Pump input 82,000 to 100,000 b.h.p. Head 164 to 238ft. Speed 150 r.p.m.

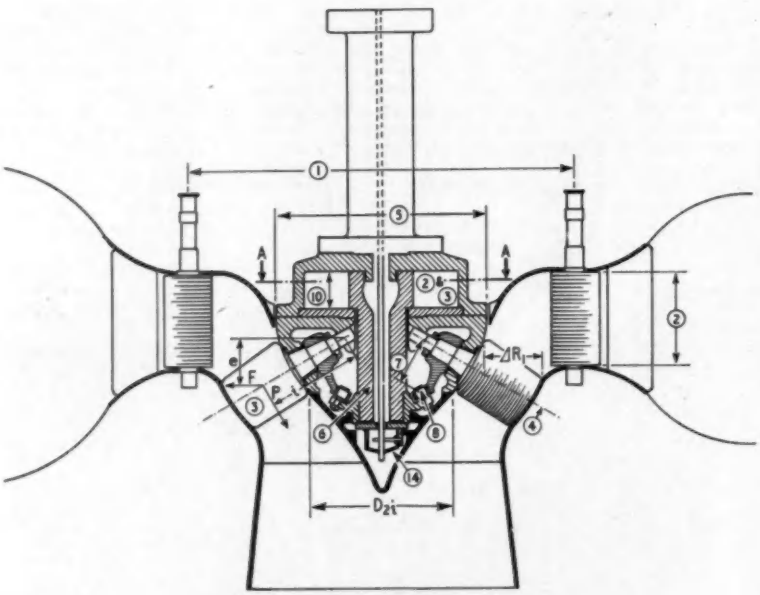


Fig. 3.—The mixed-flow variable-pitch turbine (Deriaz)

Output 30,000 b.h.p. Head 180ft. Speed 300 r.p.m. (1) Guide vane pitch circle 10ft 9in. (2) Gate height. (3) Runner blades adjustable around axis (4), which is oblique to the shaft centre line. ΔR_1 Radial extent of inlet edge of blade. D_{2i} Hub diameter at runner blade exit. (5) Hydraulic seal. (6) Servo-motor rotating shaft. (7) Blade operating lever. (8) Sliding block. (10) Moving vane servo-motor. (14) Governor restoring mechanism

Compared with the Kaplan, the Deriaz machine has a reduced mean diameter at outlet for the same outlet area. This is the result of the smaller hub diameter at blade exit (D_{2i}, see Fig. 3 and Fig. 4). This reduces the peripheral speed u_2 and hence the relative water velocity w_2. An improved cavitation factor results.

The cavitation factor is also improved by the angles β_1 and β_2 being equal. This means that the lowest absolute pressure zone is no longer on the convex side of the blade as in the Kaplan (necessitated by the deviation from β_1 to β_2), but is displaced downstream of the runner exit.

At abnormally high speeds the mixed-flow design tends to reduce the discharge. This effect is known on a Francis turbine of low specific speed, and gives a correspondingly low runaway speed compared with the Kaplan, where the axial flow results in high overspeeds and in high discharges at runaway. The reduction in runaway speed results in a cheaper generator for the mixed-flow design.

Due to its larger hub diameter at blade inlet, the Deriaz runner produces a lower hydraulic thrust than the Kaplan. This is caused by the seal of large diameter (5) on the largest hub diameter (Fig. 4) as compared with the small diameter of the shaft gland on the Kaplan (Fig. 3). The space between seal (5) and shaft gland is connected to the tailwater on the Deriaz design.

With the relatively high head under consideration it is essential for the hub to be of spherical form to prevent gaps between

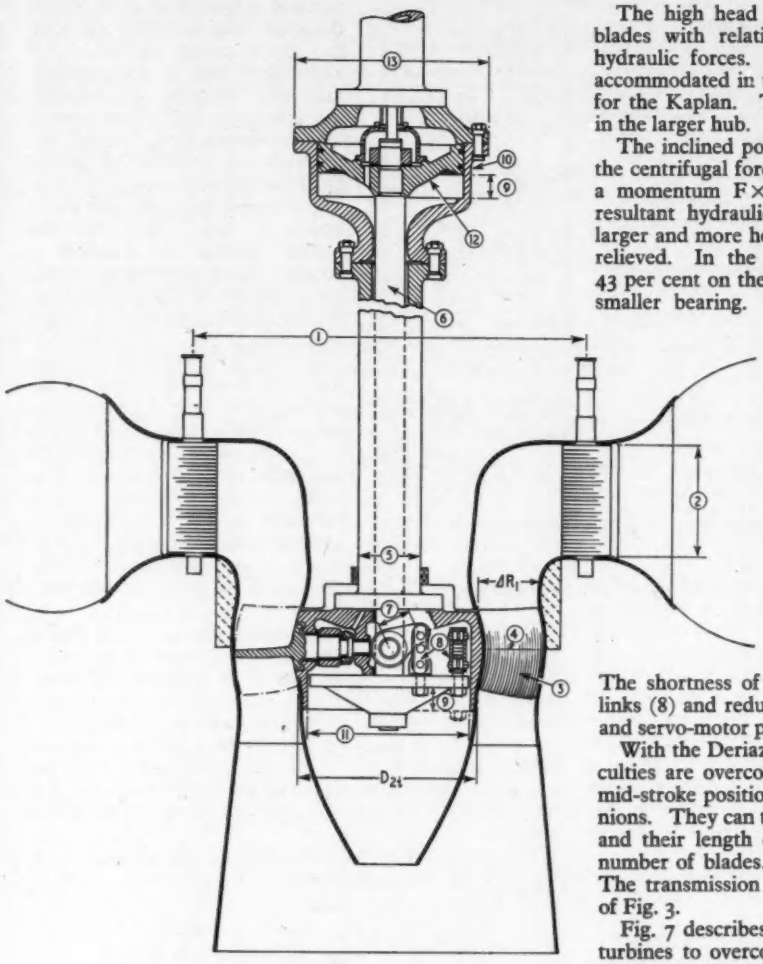


Fig. 4.—The axial-flow variable-pitch turbine (Kaplan)

Output 30,000 b.h.p. Head 180ft. Speed 300 r.p.m. (1) Guide vane pitch circle 10ft 9in. (2) Gate height. (3) Runner blades adjustable along axis (4) which is perpendicular to the shaft centre line. $\triangle R_1$ Radial extent of inlet edge of blade. D_{21} Hub diameter at runner blade exit. (5) Shaft gland diameter. (6) Operating rod. (7) Blade operating lever. (8) Blade operating double link. (9) Servo-motor stroke. (10) Servo-motor. (11) Space for alternative position of servo-motor. (12) Servo-motor piston. (13) Overall diameter of servo-motor

the blade and hub during rotations. In the Kaplan version, this spherical hub produces a marked change in direction of the flow lines at the low-pressure zone, and thus there is a further risk of cavitation. The larger Deriaz hub leads to a larger spherical radius and a less pronounced change in direction, which is at the same time well upstream of the low-pressure zone. The cavitation at the hub is therefore eliminated.

If operation as a pump is required then the mixed-flow design is able to produce a very much higher head than the axial-flow design. This is illustrated in Fig. 6. This figure was published in the paper read by the author at the World Power Conference of 1958,[3] but has since been revised in line with recent studies. These have shown the possibility of extending the application of mixed-flow design to much higher heads than was then anticipated. The dotted zones in Fig. 6 are an indication of the extensions in head that are considered practicable, both for turbine and pump operation.

The high head calls for a greater number of runner blades with relatively large trunnions to support the hydraulic forces. In the present study ten blades are accommodated in the Deriaz version against eight blades for the Kaplan. This can be achieved without difficulty in the larger hub.

The inclined position of the blade trunnions results in the centrifugal force F from the blade (see Fig. 3) having a momentum $F \times e$ opposed to the momentum of the resultant hydraulic pressure $P \times i$. It follows that the larger and more heavily loaded trunnion bearing is partly relieved. In the present study the relief amounts to 43 per cent on the larger bearing and 13 per cent on the smaller bearing. There is no corresponding relief of bearing loading in the Kaplan version of Fig. 4, because the centrifugal force is in line with the blade trunnion.

With the high heads under consideration, the operating gear common to the Kaplan turbines illustrated in Fig. 4 becomes very difficult to locate. There is very limited space between the large trunnion bearings, and the operating levers (7), which are placed between these bearings, become extremely short unless the hub diameter is increased much more than is desirable from a hydraulic point of view. The shortness of lever (7) produces high forces on the links (8) and reduced stroke (9) of the operating rod (6) and servo-motor piston.

With the Deriaz design, illustrated in Fig. 3, these difficulties are overcome as follows:—The levers (7) are at mid-stroke position in the radial plane of the blade trunnions. They can thus be accommodated without difficulty and their length can be larger even with the increased number of blades. There are no links like (8) of Fig. 4. The transmission is direct through the sliding block (8) of Fig. 3.

Fig. 7 describes a design sometimes used with Kaplan turbines to overcome the limitation on the dimension of the lever. Here the lever (2) is larger than the spacing of the trunnion centre line (1) would allow. This necessitates an intermediary bell-crank lever (4) with fixed fulcrum (5) and two double-links (3) and (6). All this mechanism has to be accommodated in the restricted space

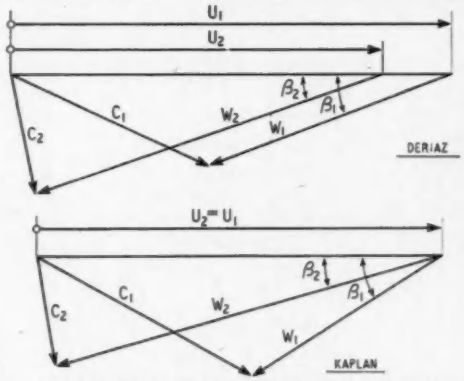


Fig. 5.—Velocity diagrams compared for the Deriaz runner and the Kaplan runner, for a mean flow-line

u_1 = Runner peripheral velocity at inlet. u_2 = Runner peripheral velocity at outlet. w_1 = Water velocity relative to runner at inlet. w_2 = Water velocity relative to runner at outlet. c_1 = Absolute water velocity at inlet. c_2 = Absolute water velocity at outlet

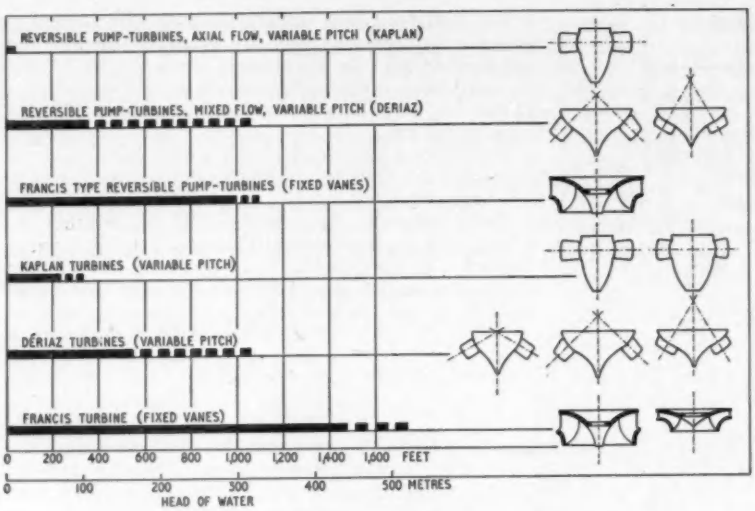

REVERSIBLE PUMP-TURBINES, AXIAL FLOW, VARIABLE PITCH (KAPLAN)
REVERSIBLE PUMP-TURBINES, MIXED FLOW, VARIABLE PITCH (DERIAZ)
FRANCIS TYPE REVERSIBLE PUMP-TURBINES (FIXED VANES)
KAPLAN TURBINES (VARIABLE PITCH)
DÉRIAZ TURBINES (VARIABLE PITCH)
FRANCIS TURBINE (FIXED VANES)
0 200 400 600 800 1,000 1,200 1,400 1,600 FEET
0 100 200 300 400 500 METRES
HEAD OF WATER

Fig. 6.—Heads under which single-stage pumps and turbines can operate

within the hub. The larger the number of clearanced pins and bearings, the less accurate becomes the control of the position of the runner blades. Considering the high degree of finish required and given to Kaplan blades, it does not seem satisfactory to introduce devices which allow for possible diversity in the angular positions of the blades.

The servo-motor of the runner blades is the item which differs mostly in the Deriaz and Kaplan designs (Figs. 3 and 4). With the Kaplan, the servo-motor has a stroke (9) axial to the turbine shaft. The servo-motor can generally be placed as shown by (10) on the shaft, where no diameter restrictions occur.

On many Kaplan designs this servo-motor can be in the position indicated by (11), inside the hub, thus avoiding the long and heavy piston rod (6). For high heads this is not possible, since the diameter (13) exceeds the available space (11). One solution consists in raising the governor oil pressure to permit reduction in servo-motor volume displacement, going to 400 p.s.i., which is not usual. Another system consists in building a double-tandem servo-motor in the space below the diameter (11) in the hub, which is very complicated.

In Fig. 3 the Deriaz version shows the servo-motor (10) of the moving vane type. The section AA is given in Fig. 8 and shows four fixed vanes (3) attached to the body (1) and four movable vanes (2) attached to the operating shaft (6). These vanes separate eight chambers, four of which (4) give movement in one direction when filled, while the four others (5) are connected to exhaust, and vice versa.

The servo-motor height (10) (see Fig. 3) can be varied to suit the energy required to operate the runner blades without an increase in the overall diameter of the servo-motor body. The shaft (6) operates over the angular stroke (9) of Fig. 8. Its displacement is transmitted to the levers (7) of Fig. 3 by a mechanism which is given in further detail in Fig. 9. For clarity, the blade trunnion is not shown, but only its centre line. Again, on the end view the pins (14) have been removed for the same reason.

The gear is drawn for position of mid-stroke, as for Fig. 8. As the servo-motor shaft (6) assumes other positions, the levers (7) incline, as can be seen in the photograph, Fig. 10, which shows the levers in the blades shut position.

The geometrical requirements for correct functioning are that the centre line of the pin (14) and its sliding

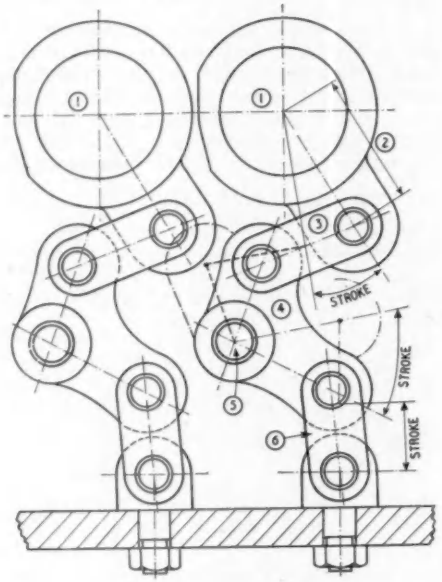


Fig. 7.—Special linkage in Kaplan gear

(1) Blade trunnion centre lines. (2) Operating lever. (3) Double link. (4) Bell-crank lever. (5) Fixed fulcrum for (4). (6) Double link

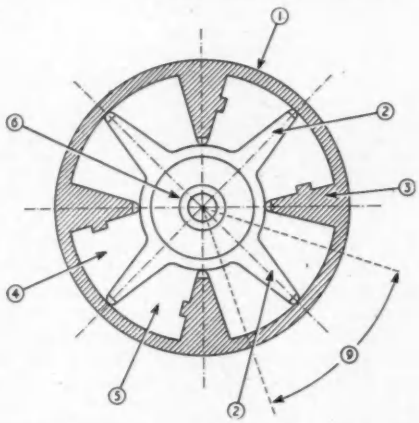


Fig. 8.—Vane servo-motor. Section through AA of Fig. 3

(1) Servo-motor body. (2) Movable vane of rotor. (3) Fixed vane. (4) Left-hand chamber. (5) Right-hand chamber. (6) Operating shaft. (9) Stroke of vane (2)

	Kaplan Blade tip dia. 20·44in. Number of blades 8			Deriaz Dia. at tip of blade on trunnioncentreline20in. Number of blades 10		
At unit speed corresponding to operational head on prototype of	180ft	190ft	at optimum speed	180ft	190ft	at optimum speed
Model efficiency %—						
at full load	87·1	87	87	89·5	89·7	89·3
at best load	88·2	88·2	88·2	90·8	90·8	91·7
at half load	87·5	87·7	87·7	88·1	88·3	89·3
Maximum runaway speed as ratio of synchronous speed—						
on cam	2·06	2·10	2·10	1·65	1·70	1·72
off cam	2·40	2·47	2·47	1·91	1·96	2·09
Maximum discharge as ratio of full load discharge at full gate and blade openings ...	1·49	1·48	1·48	1·02	1·04	1·01
Cavitation actor at full load—						
Sigma (limiting) ...	0·380	0·388	0·388	0·318	0·300	0·32

block (8) meet point (16) where the runner blade trunnion centre line and the vane servo-motor centre line meet. This construction is new and protected by patent.

The moving vane servo-motor as in Fig. 8 is somewhat more intricate to manufacture than a plain cylindrical servo-motor. It brings, however, considerable simplification elsewhere and is thereby fully justified economically. It has proved entirely reliable in service.

When the Kaplan turbine is designed for high heads it is essential for the runner envelope to be spherical both above and below the blade centre line, in order that there shall be no gap between blade and envelope. It follows that to dismantle the machine the upper half of the envelope must be removable. The shaded part of Fig. 4 indicates the portion of the envelope that must be made removable. The Deriaz type runner is free from this difficulty. The spherical surface is built all along the runner skirt and at the same time this part can be concreted in once and for all, as it requires no subsequent dismantling.

Gap cavitation requires close supervision, especially for high heads. This cavitation is caused by the clearance between the tips of the runner blades and the fixed envelope surrounding them. With the axial runner (Kaplan) this clearance is fixed at the time of manufacture and cannot be controlled thereafter without modifications to the blade tips.

With the mixed-flow (Deriaz) design this clearance is readily adjusted by setting the position of the runner in such a way that only the required running clearance is allowed. This adjustment does not involve any dismantling, and is achieved by the setting of the thrust bearing pads. It therefore follows that the mixed-flow design is much better suited to high heads than the axial-flow design. The shorter runner hub and the lighter generator design permit the installation of a lower crane of smaller capacity with the Deriaz design. This leads to very valuable economy in building costs.

Comparative tests have been made on model turbines at the Hydraulic Department Test Station of the English Electric Co. in Rugby, for the application of the machine to an order placed by the North of Scotland Hydro-Electric Board. The tests on the model of the Kaplan and that of the Deriaz runners were carried out in the same rig with the same calibrations. Apart from the runner and runner envelope, the only differences to the rigs were in the upper draft tube and guide cover. The spiral casing, the gate apparatus and the draft tube bend were the same in both tests. A summary of these tests is given in the table above.

It should be pointed out that the optimum speed for the Deriaz runner is slightly below the optimum speed

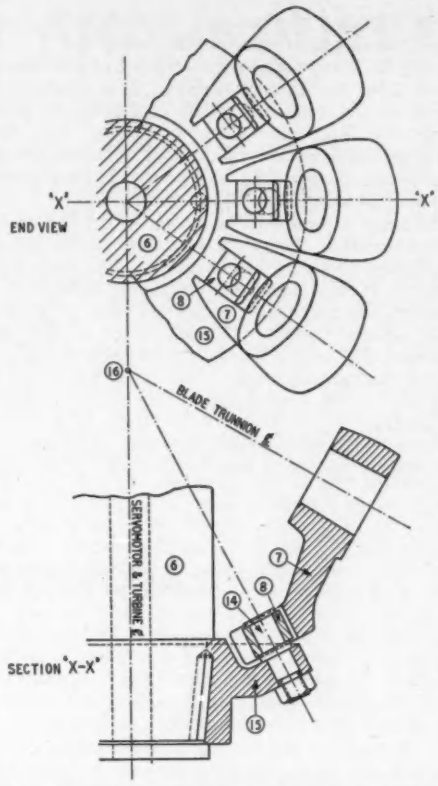


Fig. 9.—Transmission mechanism from vane servo-motor to runner blade trunnions

(6) Servo-motor rotating shaft, coaxial with turbine shaft. (7) Runner blade operating lever. (8) Sliding block pivoted on (14). (14) Pin attached to spider (15). (15) Spider keyed to (6)

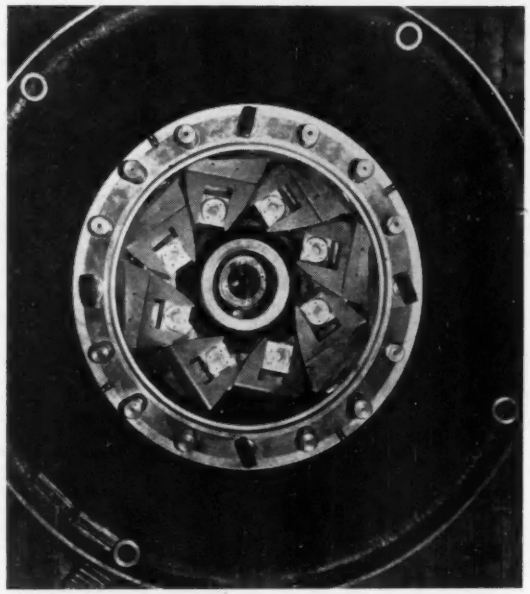


Fig. 10.—View of blade mechanism at Niagara, showing forked ends of levers with sliding blocks when blades are in closed position

for the Kaplan. Furthermore, the model efficiencies are those obtained on the test rig without step up.

It will be noted that comparatively low efficiencies are recorded for the Kaplan turbine. It is usual to reach 90 and 91 per cent on models of Kaplan turbines for specific speeds of 400 to 600 n_s metric. For the very high head under review, efficiencies are down by two or three points because the excessively large runner hub gives an unfavourable hydraulic profile.

The much reduced runaway speed of the Deriaz runner allowed a radical change in the design of the alternator. This in turn allowed a lighter crane. The maximum discharge is at any over-speed including runaway. This maximum discharge determines the size of excavation of the tailrace tunnel. The advantage of the reduced maximum discharge is thus of considerable importance to the civil engineering work. The cavitation factor sigma (limiting) is the lowest figure at which operation is satisfactory.

The test results support the view expressed at the beginning of this article that for heads in excess of 120ft, the mixed-flow turbine has marked advantages and should replace the purely axial turbine. As a result of these tests it was decided to proceed with the construction of the Deriaz turbine at the rated output of 30,500 b.h.p. at 180ft and 32,500 b.h.p. at 190ft head, running at 300 r.p.m. The turbine and generator will be of English Electric design and manufacture, and will be installed at the Culligran power station of the North of Scotland Hydro-Electric Board. The consulting engineers are Messrs. Kennedy & Donkin.

The author thanks the English Electric Co., Ltd., for permission to publish this material, which was originally presented as a paper at the golden jubilee celebrations of the Indian Institute of Science in Bangalore last month.

REFERENCES

[1] Bulletin Technique de la Suisse Romande. P. Deriaz. La Turbine-Pompe Reversible Axio-Centrifuge a Pas Variable, 20th October, 1955.

[2] Reversible Pump-Turbines for Sir Adam Beck, Niagara, Pumping-Generating Station, A.S.M.E. Paper 58-A108, December, 1958.

[3] P. Deriaz and J. G. Warnock. Economic Advantages of Variable-Pitch Runners for Water Turbine Pumps. World Power Conference Paper 130A_2/5. Montreal, September, 1958.

LABORATORY OPEN DAYS

TWO of the five divisions—Plant Engineering and Energy, and Ironmaking—and the three departments—Physics, Chemistry and Operational Research—into which the British Iron and Steel Research Association is organised have laboratories in London, representing about one-third of the Association's activities. With the exception of the ironmaking division's blast furnace laboratory at Imperial College, they are all housed at Battersea, where a rebuilding programme is in progress, a four-storey block of offices and laboratories having recently been completed.

Among the exhibits representative of the work of the various research sections comprising the London group, which were displayed during two open days held recently, were a number of electrical interest. The advantages of using electronic computers in the steel industry has been investigated by the Operational Research Department. Full-scale studies of their use in a production allocation office have been made for two companies and an investigation has been carried out into reducing waste at the hot saw in a rolling mill by using a computer to determine the best combination of lengths to be cut to meet customers' orders.

The "Translator" equipment, which has been developed to assist rolling mill operators selecting successive roll settings, can store more than 600 rolling schedules. Switches are set to suit the weight, finished dimensions and temperature of the ingot to be rolled, each combination of switch settings selecting the appropriate rolling programme and the rolls being automatically successively positioned by pressing a "next-pass" button.

The Association is developing a method for continuously measuring strip speed, necessary to determine the reduction in gauge in the temper rolling of steel strip, in which two photocells are sighted on illuminated spots on the strip surface. Small irregularities in the light reflected from the strip give rise to a pattern in the output of the first photocell and, after a time interval depending on the distance between the cells and the strip speed, in the second photocell. The output of the first photocell is delayed and added to the signal from the second, and the strip speed can be calculated from the delay time necessary to give a maximum combined output.

In a preliminary study of possible methods of heating ingots before forging, it was established that mains frequency induction heating was an economic proposition and further work is in progress on applications of this technique. This involves the consideration of new handling methods, new heating schedules to establish maximum heating rates, the economics of changing frequency to match stock size with electrical efficiency, the design of coils to fit different stock shapes and the fitting of an induction heating plant into forge shop schedules.

In an instrument being developed for inspecting tinplate sheet surface quality, a high-intensity strip lamp illuminates a $\frac{1}{10}$in wide band across the full width of the moving tinplate. Each 1in segment of this band is viewed by a separate photocell at an angle between 5 and 30° to the direction of illumination. Under these conditions prime tinplate gives no output signal, while a defect generates a signal which depends on the degree of the defect and the ratio of its area to the total area of strip viewed by the photocell. To reduce the electronic equipment required, each photocell is sampled in turn, and rectangular hysteresis-loop ferrite cores are used for the dual role of sampling and classifying. The next development stage will be the establishment of a relationship between the pulse count given by the instrument and the acceptability of the tinplate for its various applications.

LIFT CABLES

THE revision of B.S. 977, the British Standard for travelling cables for electric lifts, is confined to braided cables, the design of which has been improved to give increased flexibility. A new flexibility test has been introduced and the fire-resistance test has been made more stringent. The electrical requirements are generally in accordance with those for general-purpose rubber-insulated cables given in B.S. 7. Copies may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 4s.

IRRADIATION AND INDUSTRY

A short review article, based on the Utilisation Section paper entitled "The Application of Irradiation in Industry" which was read before an ordinary meeting of the Institution of Electrical Engineers on 5th November

By M. C. Crowley-Milling, M.A., A.M.I.E.E.*

OVER the last ten years, the effects of ionising radiation on many materials has received intensive study and it has been shown that there are many applications of potential commercial significance. The thermal properties of some plastics can be improved and both natural and synthetic rubber can be cured. Many chemical changes can be produced or initiated and pharmaceutical products can be sterilised. The keeping qualities of foods can be improved both by the reduction of bacteria and by the destruction of insect pests. Some of these processes are being tried out on a pilot-production scale, and others are in full commercial use. The widespread use of irradiation processes will call for an understanding of the properties of the different types of radiation, and their application.

The two types of ionising radiation suitable for large-scale industrial use are high-energy electrons and the γ-rays produced during the decay of radioactive materials. Large currents of high-energy electrons can be produced by accelerators such as the Van de Graaf, the resonant transformer, and the microwave linear accelerator. The energy of the electrons from the first two of these is limited by insulation difficulties, for industrial applications, to 3 MeV. There is no such limitation on the linear accelerator, since the electrons gain their energy from a radio frequency wave, avoiding the need for very high voltages. Radioactive materials are available as the products of nuclear fission, and there has been considerable interest in the possibility of using these "waste" products for commercial irradiation. However, there are many practical difficulties to be overcome, and most of the experimental γ-ray irradiation units use the radioactive isotope of cobalt, Co^{60}, produced by bombarding metallic cobalt with neutrons in an atomic pile.

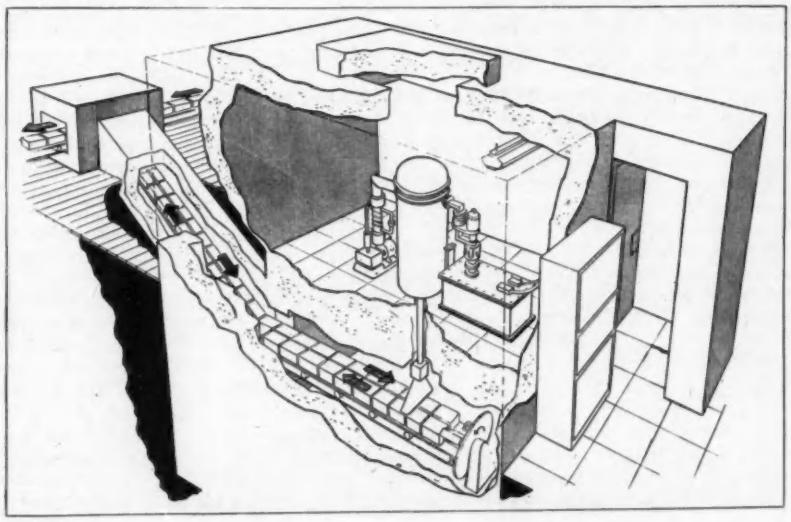
The differing properties of electrons and γ-rays call for different techniques in their application if the best results are to be obtained. γ-rays are emitted in all directions, and can penetrate a considerable thickness of material, the intensity of ionisation falling off approximately exponentially with thickness. Therefore, it is necessary to have several layers of the material to be irradiated on each side of the source, which is usually in the form of a flat plate, and the material must be circulated to even out the dose received. The mean dose-rate is not high and so, in the case of a high-power irradiator, it is necessary to have a large quantity of material circulating slowly. Thick shielding must be provided all round the large irradiation chamber and means must be provided for the removal of the source to a safe place when access is needed to the irradiation chamber for maintenance.

High-energy electrons have a limited range of penetration, depending on the electron energy and the density of the material. The intensity of ionisation is fairly uniform over most of this range, but the uniformity can be improved and the thickness that can be treated with a given energy increased, by irradiation from both sides. This can be done by turning the material, or by splitting the beam. Under such conditions, the highest efficiency is achieved if the electron energy is about 3 MeV for each inch of unit density material, or its equivalent. The beam from an electron accelerator is well defined and can be spread or scanned just to cover the width of the material, so the efficiency of utilisation can be quite high, up to 80 per cent. The dose-rate can be very high, requiring a small irradiation chamber. Thick shielding is needed only in the direct line of the electron beam. For applications where large doses are required, it may be necessary to give a number of smaller doses, with cooling periods, to avoid overheating of the material.

Present Applications

There are several industrial plants now in full-scale operation. Van de Graaf and resonant transformer accelerators are used for the irradiation of polythene-coated wire and polythene tape, and for the sterilisation of pharmaceutical products. A linear accelerator is in use for the sterilisation of surgical sutures. These machines vary in output from 0·5 to 10 kW, and in energy

* Research Department, Metropolitan-Vickers Electrical Co., Ltd.



An irradiation plant suitable for treating rectangular boxes

from 1 to 7 MeV. The first industrial γ-ray irradiation unit is being installed in Australia for the sterilisation of hair used in carpet manufacture. This is to have a cobalt source of 150,000 curies (2¼ kW).

Plant suitable for the irradiation of rectangular boxes of material is illustrated on page 653. It is designed for incorporation in an existing production line and the irradiation chamber is underground for economy of shielding. The boxes are conveyed underground, passed through the electron beam, turned over and then returned through the beam, which is spread to cover both conveyors. A 6 MeV, 5 kW linear accelerator is mounted above the ground in a shielded room. The total cost of treatment with such a machine would vary from a few shillings a ton for killing insect pests to a few shillings a pound for cross-linking plastic mouldings.

The author wishes to thank Sir Willis Jackson, director of research and education, Metropolitan-Vickers Electrical Co., Ltd., for permission to publish this summary.

DISCUSSION

The discussion was opened by Mr. S. Jefferson (U.K.A.E.A.) who said that the potentialities of radioactive isotopes as sources of radiation had been played down too much in the paper. It was now possible to negotiate with the A.E.A. for deliveries of cobalt 60 and to buy a kilowatt of gamma energy for about £20,000. The two methods were largely complementary. For surface treatments or thin films electrons were often more convenient and their limited penetration not a serious disadvantage, but in many manufacturing processes penetration was essential. If an attempt were made to achieve penetration by putting up the quantum energy of electrons above 10 MeV there would be increasing photo-neutron generation and activation of the material.

Mr. C. W. Miller (Metropolitan-Vickers) recalled that more than ten years ago he had investigated the possibilities of sterilisation with 3 cm and 10 cm radio waves, but the experiments had been unsuccessful. Ten years ago, when a linear accelerator of 8 MeV became available, he had done experiments with electron irradiation which had been immediately successful. It was disappointing that it had taken ten years for industrial applications to become apparent, but in fact the first suggestion of sterilisation in this manner had been made in a German paper in 1896, a year after Röntgen discovered X-rays. It was of interest that there was now a linear accelerator available rated at 1½ kW and capable of being uprated to 2 kW.

Mr. T. R. Manley (Reyrolle) said the major interest in the application of irradiation was its application to plastic materials. The discovery of chemical means of polymerising polythene had dealt a severe blow to the use of irradiation, but there were other olefines than polythene and the higher one went up in the scale the more efficient was irradiation.

Mr. G. Saxon urged that the question of induced radioactivity, which was always raised when electron irradiation was discussed, should be put in its proper perspective. With beryllium the product had a half-life of only 10^{-14} sec. He had calculated the induced activity in the case of goat-hair bales which had been irradiated with 25 MeV electrons. The only serious activity was that produced in the carbon, and the half-life of radioactive carbon was only 20 min, so that with a storage period of two to three hours the activity would be down to background level.

Mr. S. Jefferson, invited by the president to defend himself, said the point at issue was whether or not he had attached too much importance to radioactivation. Here it was the 10-15 MeV region which was important, but with beryllium it was not the half-life of the radioactive material but the fact that a neutron was produced which was important. They would never recommend a fuel element pond for a manufacturing process. The half-life of the decaying fuel element changed continuously and it was difficult to achieve high efficiency in a water pond. There were a few neutrons present, and therefore they never processed anything in the pond where the background of neutron flux was of any importance.

The author, in reply, said Mr. Jefferson had given the interesting figure of £20,000/kW for his cobalt. It was likely that the gamma ray source, if utilised for 24 hours a day, would have the same price per kilowatt of gross power as electron accelerators, but the electron accelerator could apply its power more usefully. While 30 per cent was probably the top limit for the gamma source, for the electron machine the top limit would be about 80 per cent. With regard to the irradiation of food, the American Quartermasters' Division had calculated that the amount of additional irradiation one would absorb by eating a ton of treated food a year, irradiated by electrons at 24 MeV, would be less than the difference between the background rate in Chicago and in Detroit or between living in a wooden house or a stone one.

Railway Electrification Conference

WE have already briefly reported that it is proposed to hold a British Railways Electrification Conference during the first week in October next year. The British Transport Commission has now issued a statement on the subject in which it says that the Conference is being called to show railway administrations throughout the world what British Railways are achieving in a.c. electrification and to exchange with them views on the problems which have to be met. A series of papers will be presented covering all the new technical developments in a.c. electrification on British Railways and overseas visitors will be shown sections of electrified line which will either be already in operation or in various stages of completion.

The British electrical manufacturing industry is co-operating with the Commission and will co-operate in staging an exhibition of railway electrification equipment and rolling stock at the same time as the Conference. This exhibition, to be held at British Railways' Battersea Wharf, London, will be the largest and most comprehensive display of electric rolling stock and railway electrification equipment yet assembled in this country.

The arrangements for the Conference and exhibition are being made jointly by the Commission, the British Electrical and Allied Manufacturers' Association, and the Locomotive and Allied Manufacturers' Association. The two manufacturers' organisations are also planning to follow the Conference with a series of inspections of many of their members' works where the visiting engineers will be shown locomotives and electric traction and electric supply equipment in production.

Sir Brian Robertson, chairman of the British Transport Commission, has already written to foreign railway administrations inviting them to send their electrical and signal engineers and other interested technical officers. It is expected that between 300 and 400 delegates from abroad will attend the Conference, which will take place at the Institution of Civil Engineers.

INDUSTRIAL NEWS

Dollar Imports Freed

The latest relaxation of import controls means that all electrical equipment and apparatus except transistors can now be imported from the United States and Canada and other countries of the Dollar Area without restriction. Controls are retained on the import of radioactive materials. The present tariff, including Commonwealth Preference, is left unaffected.

For imports from Japan and the countries in the Eastern Area (that is, the Soviet Union and other countries in the Soviet bloc) there is no change in the existing import licensing arrangements, but China is now included in the eastern area.

A Notice to Importers (No. 920) setting out the revised licensing arrangements, which came into effect on Monday, has been issued by the Import Licensing Branch of the Board of Trade.

Last week's announcement by the President of the Board of Trade is the fourth step to be taken by the Government in the past two years to dismantle the financial and commercial controls introduced twenty years ago at the beginning of the war. In June import controls were removed from a wide range of dollar consumer goods, including domestic electrical appliances, radio, television and sound reproducing apparatus and from certain types of telecommunications and electronic equipment.

S.I.M.A. Delegation to Russia

On Monday last a three-man delegation of the Scientific Instrument Manufacturers' Association of Great Britain (S.I.M.A.) left London Airport for Moscow. The visit is being made at the invitation of the All Union Chamber of Commerce, Moscow, and the delegates are Mr. F. Hamill (Hilger & Watts, Ltd.), Mr. H. D. Binyon (Solartron Electronic Group, Ltd.) and Mr. K. A. Macdonald (Unicam Instruments, Ltd.). They will explore the possibilities for a specialised exhibition of British scientific instruments, supported by demonstrations and specialist lectures, to be arranged in Moscow, provisionally in the second half of next year. Already thirty-six scientific instrument manufacturers have expressed their willingness to participate on the successful conclusion of negotiations. It was expected that the delegation would spend about four days in Moscow.

Crompton-Varley Batteries

Crompton Parkinson, Ltd., and Varley Dry Accumulators, Ltd., announce that a range of batteries for motor cycles, motor scooters, electric (wire) fence and low-voltage cells and batteries for a wide variety of applications, are to be manufactured by Varley for Crompton Parkinson, Ltd. The batteries will carry the brand-name "Varley" together with the wording "Made for Crompton Parkinson, Limited," moulded on the container. These batteries will be handled through the Crompton selling and distribution organisation responsible for the marketing of Crompton car and commercial vehicle batteries.

Surfeit of Uranium?

It is reported that the Canadian Government has been unable to secure an extension of the contracts with the American and British Governments for the supply of uranium oxide. The Ottawa correspondent of *The Times* says that this will place the fourteen Canadian producers in difficulties when the contracts end. The arrangement with the British Government expires on 31st March, 1963, but the producers can extend deliveries until 1966.

A.E.I. Overseas Companies

On 1st July last Associated Electrical Industries, Ltd., announced, as part of its programme of integration, the establishment of a number of selling companies overseas trading in the name of A.E.I. The first of these to become operative was A.E.I. (Canada), Ltd., and on 1st November a further four companies began operating. They are:—Associated Electrical Industries Central Africa (Private), Ltd., Salisbury, Southern Rhodesia (Mr. C. R. Deglon, chairman and managing director); Associated Electrical Industries South Africa (Proprietary), Ltd., Johannesburg (Mr. D. W. Stanley, chairman and managing director); Associated Electrical Industries (N.Z.), Ltd., Wellington (Mr. J. H. Lee, chairman, and Mr. K. C. Ford, managing director); and Associadas Eletro-Industriais do Brasil Lda., Rio de Janeiro (Mr. F. C. Hallawell, director and general manager).

Japanese Activities in Ireland

A Japanese concern, the Sony Corporation, is planning the formation of a company in the Irish Republic to undertake the manufacture of transistor radio sets. Its factory will be one of those erected with Governmental financial assistance by the Shannon Airport Development Co. An output of 20,000 sets a month by 1963 is envisaged.

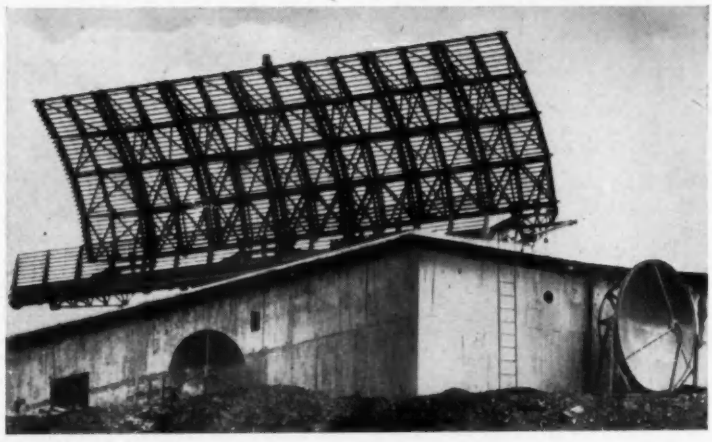
Training Industrial Designers

A source of reference for United Kingdom manufacturers and educationalists concerned with the problem of producing industrial designers is provided by a 60-page booklet published by the Federation of British Industries. "The Training of Industrial Designers (Engineering)" is the report of a conference held by the F.B.I. last May, when the subject was discussed by leading industrialists and educationalists. All papers given at the conference are reported fully in the booklet, which is obtainable from F.B.I. Print Publications, 21, Tothill Street, London, S.W.1, price 5s.

High Power Radar Installation

Both long range airways cover and short range airport approach control are combined in a single high power 50 cm 500 kW radar installation supplied and installed at Wellington (N.Z.) airport by Marconi's Wireless Telegraph Co., Ltd. Either unit of the dual transmitter/receiver installation can be switched to a common radar aerial. Two-way microwave radio links are provided, over which radar signals are passed to displays at the airport and the control centre

The main aerial, with two microwave link dish aerials, in process of installation



some four miles away. The links also provide a path for the remote control of the radar head which normally operates unattended. Radio link paths were chosen for this duty in preference to coaxial lines because of both cost and the risk of cable fracture in seismic disturbances. The radar head, which weighs 7½ tons and is 52ft 6in long, stands at the highest point on a ridge, 1,630ft high. It can turn at full speed at winds up to 60 knots, at half speed up to 90 knots and can withstand 120 knots. Since the equipment operates on a 50 cm wavelength, aircraft echoes displayed are not obscured by those from rain storms, although these are faintly displayed, enabling the controllers to give aircraft avoiding routes.

Educational Films

The latest edition to the advanced science series of films released by the Educational Foundation for Visual Aids is "Photo-Emission," which had a private viewing in London recently, and is primarily intended for showing in technical colleges and similar institutions. It opens by showing the construction of the photo-electric cell and by demonstrations expounds the laws of photo-emission. The film ends by showing a number of applications of photo-emission to industry. It is a 16 mm black and white sound film with a running time of 18 minutes.

Copies of the film can be purchased from the E.F.V.A., 33, Queen Anne Street, London, W.1, or can be hired from the Foundation Film Library, Brooklands House, Weybridge, Surrey.

Electric Floor Warming Brochure

Of interest to architects, builders and people considering buying or building a new house is an eight-page illustrated brochure entitled "Electric Floor Warming" which has just been published by the Electrical Development Association. It answers such questions as what are its advantages, how is it installed, how controlled and how it affects house planning. The booklet claims that electric floor warming is less expensive than other forms of heating, the cost of installation varying from about 3s 6d per sq ft of floor warmed, according to the type of installation and the construction of the house. Copies of the brochure can be obtained from Electricity Service Centres or from E.D.A., 2, Savoy Hill, London, W.C.2.

Design for Marketing

Richard Lonsdale-Hands Associates, Ltd., was founded in 1937 to provide a regular service of design for industry, and the organisation has so grown that it now occupies three floors in Commonwealth House, New Oxford Street, London, W.C.1, and has a staff of 150. Recently we had an opportunity of seeing some of the work which this company is carrying out when we made a tour of inspection of the various design divisions. These

The colour, light and density evaluator ("Clade") devised by Richard Lonsdale-Hands Associates, Ltd.

comprise divisions for packing, interior design, exhibition design, product design and design of point-of-sale and display material. In order to provide a practical method of showing designs in actual sale conditions and comparing trends in design appeal, a showroom has been fitted up as a shop on the self-service principle, from which the staff is able to purchase groceries and similar commodities.

One of the latest developments of the company on the technical side in assessing package design is a colour, light and density evaluator ("Clade") which the company has constructed to gauge the effectiveness of pack design under all conditions at point of sale. This device is box shaped, with a viewer, and by operating different controls the effect of lighting by tungsten lamps, various forms of fluorescent lighting, and combinations of these illuminants, on package designs can be seen.

Code for Selective Tendering

The cost of tendering is a not inconsiderable element in the cost of building, and the larger tender lists become the greater will be the cost of abortive tendering. To help improve the efficiency of tendering, and so contribute to a reduction of building costs, the Joint Consultative Committee of Architects, Quantity Surveyors and Builders has recently published a Code of Procedure for Selective Tendering, and an open meeting to discuss the code is to be held at the Royal Institute of British Architects, 66, Portland Place, London, W.1, on Monday, 16th November, at 5.45 p.m.

The code recommends restricting tender lists to an average of six names, with an absolute maximum of twelve for very large contracts. If the list is restricted to firms capable of doing the job, then the final choice will be simple —the builder offering the lowest price. It is "unreasonable to expect builders to guess how the building owner may value time saved against the additional cost of accelerated work." The code lays down a method of correcting pricing errors before an offer is accepted. It emphasises that rapid notification of results of tendering is a public duty, and recommends that tenderers should be present when tenders are opened.

Hoover Action Discontinued

Charles Colston, Ltd., announces that the action by Hoover, Ltd., against Sir Charles Colston for alleged breach of restrictive covenant has been discontinued. The action was begun in May, 1955, and included Charles Colston, Ltd., as a defendant. Hoover, Ltd., have paid the agreed costs of the defendants and are also liable for their own costs. Sir Charles Colston was formerly chairman and managing director of Hoover, Ltd. He resigned from the board in 1954, having been with the company since 1919. After leaving Hoover, Ltd., he formed Charles Colston, Ltd., in 1955. The company manufactures and markets domestic appliances.

A statement issued by Hoover, Ltd., says that the action was brought by the company as a result of Sir Charles Colston's public announcement about his future business plans. It was discontinued only after the end of the five-year period during which Sir Charles' business activities were restricted under his covenant with Hoover, Ltd.

Design of Home Equipment

The design, performance and safety of home electrical equipment will be considered by representatives of various branches of the Electrical Association for Women at a meeting to be held at 2 p.m. on 18th November at the Institution of Electrical Engineers, Savoy Place, W.C.2. Mr. H. Upjohn, M.S.I.A., industrial officer of the Council of Industrial Design, will deal with the practical and æsthetic aspects of home equipment, and Mr. R. Harvey, B.Sc., manager of the E.D.A. Testing House, Leatherhead, will describe some of the steps taken to ensure the efficiency and safety of home electrical equipment. Miss Mary George, M.B.E., director of the E.A.W., will be in the chair.

Ministry of Pensions Computer

An order for an all-transistor "Emidec 2400" computer costing over half a million pounds to be manufactured and installed at Newcastle has been placed with E.M.I. Electronics, Ltd., by the Ministry of Pensions and National Insurance to deal with the data processing connected with the new Graduated Pensions Scheme.

It has been calculated that there are 25 million insured persons, with over a million additions or changes each year. The computer will store full statistics—name and address, amount of each contribution and sum paid to date—and the records of every insured man and woman in the United Kingdom will be processed daily to

extract the required information for persons reaching retirement age, and other changes in personal particulars, a task which can be completed in under four hours. The number of forms which will have to be processed yearly will total over 30 million. The computer will have seventeen "Emidata" fast start-stop decks and, for processing data in the "deep store," five 4in tape decks, and a new type of printer capable of producing 3,000 lines a minute will be used. All plug and socket connections will be gold-plated to ensure reliability.

Liverpool Lighting Exhibition

The world's first electric lamp is among the exhibits displayed at an exhibition entitled "Lighting Progress," staged at the Merseyside and North Wales Electricity Board's Industrial Development Centre, Paradise Street, Liverpool, which opened on Tuesday last and continues until 20th November. The original Swan lamp is part of a display outlining the history of lighting through the ages, leading to the present-day "ideal" in lighting for the home, office, shop, factory and workshop. On view for the first time is a scale model of a permanent supplementary artificial lighting installation, designed by Dr. A. Hopkinson at the Watford, Herts., research station of the Department of Scientific and Industrial Research, and a daylight factor meter manufactured by Evans Electro-Selenium, Ltd. The exhibition has been organised by the Board in conjunction with the Merseyside Electric Lighting Services Committee, to celebrate the golden jubilee of the Illuminating Engineering Society.

A.E.I.-Hotpoint Research and Development Centre

A.E.I.-Hotpoint, Ltd., is to build a new research and development centre on a site adjacent to its Peterborough factory. Work is beginning at once and it is expected that the building will be ready for occupation by next September. The site is large enough to accommodate four additional blocks of similar design and these will be erected to meet future requirements.

The two-storey building will have a total floor area of 27,000 sq ft and the principal accommodation on the ground floor will comprise two large laboratories and a spacious lecture theatre. The drawing office will occupy two-thirds of the second floor with suites of engineering offices adjoining. The cost of the first stage of the construction of the centre will be about £250,000.

Change of Name

The Synthetic Carbon & Engineering Co., Ltd., has changed its name to Morgan Components, Ltd., in order to clarify its association with the parent company, the Morgan Crucible Co., Ltd. The capacity at Stanmore has been enlarged and will be concentrated on the sales and production of all brush holders hitherto manufactured by the Morgan Crucible Co. and the Synthetic Carbon & Engineering Co. It is planned to add to the range of brush holders. These will be marketed under the trade name "Morganite." Morgan Components will continue to manufacture and supply a variety of metal contacts and associated metal assemblies, which were formerly supplied by the Synthetic Carbon & Engineering Co. Inquiries and orders for carbon brushes and carbon contacts, formerly supplied by the Synthetic Carbon & Engineering Co., should now be sent to the Morgan Crucible Co., Ltd., Battersea Church Road, London, S.W.11. The grades of carbon used will be as previously supplied but the grade markings will conform to the "Morganite" series. The interests of the Morgan Crucible Co. and Morgan Components, Ltd., will be covered by a single force of sales representatives.

Telephone Cables for London-Birmingham Motorway

For the new London to Birmingham Motorway which was opened on 2nd November an emergency telephone service for the free use by the public has been installed, which enables the public to call the police directly in cases of emergency, both quickly and efficiently.

The telephones are housed in special pillars at one-mile intervals duplicated on each side of the dual highway. There are 144 pillars and the cables to connect them were specially designed by the Post Office and manufactured by the Telegraph Construction & Maintenance Co., Ltd., at its Greenwich factory. The cables are essentially simple in design, but it was necessary to extrude the core insulation to a high degree of accuracy in order to meet the capacitance unbalance requirements laid down by the Post Office. The mean capacitance unbalance was achieved with a substantial margin over that specified.

Two types of cable were used, single-quad and three-quad. In the case of the single-quad cable, conductors are 40 lb (0·050in diameter) plain soft copper wire insulated with polythene of melt flow index 2. Four such insulated cores are twisted together around a centre polythene string and whipped with nylon, followed by a lapping of Terylene (polyethylene terephthalate) tape. The construction of the three-quad type of cable is similar. A final black sheath of polythene of melt flow index 0·3 with carbon black and butyl rubber was then applied. The total order amounted to just over 150 miles, of which two-thirds was single-quad and one-third 3-quad cable.

Scientific Instrument Deliveries

Figures of the volume of total and export deliveries of certain scientific instruments and industrial measurement and control apparatus are now being published regularly in the *Board of Trade Journal*. Apart from their direct value in providing information about changes in the activity of this industry, the growth of home deliveries of industrial apparatus is an indication of the extent to which automatic control systems are being introduced by other industries.

Between 1956 and 1958 the output of the industry increased by 9 per cent compared with no net change in total industrial production and an increase of only 1 per cent in total manufacturing. In the first half of this year output was 6 per cent higher than in the corresponding period of 1958 and export deliveries were 7 per cent more. Increased deliveries, to both home and export markets, of electronic computers and industrial process measuring and control instruments are responsible for the expansion of total deliveries this year.

Production Lines in School

Production lines for the making of switches and chokes specially built and installed at a Havant school formed part of an unusual and interesting exhibition staged by the Plessey Co., Ltd., recently. As well as being shown

Pupils of Oak Park School, Havant, inspecting the production lines which formed part of a recent exhibition staged by the Plessey Co., Ltd.

assembly lines in operation, visitors saw a display of equipment illustrating the extent of Plessey activities throughout the country. Pupils of the school had a preview before their parents arrived.

Identifying Photographs

Once again we ask all those who send us photographs, particularly personal portraits, to make sure that particulars are given on the back of the prints. Confusion can arise when photographs become separated from accompanying letters, as sometimes happens when a heavy post is being dealt with.

Lighting for New Canadian Pacific Liner

The General Electric Co., Ltd., has received an order valued at about £30,000 for the supply of "Osram" cold cathode lighting in the public rooms of the new 27,000-ton liner now being built for Canadian Pacific by Vickers-Armstrongs (Shipbuilders), Ltd., Newcastle-upon-Tyne.

Church Installation

The Eastern Electricity Board has just completed the installation in Burwell Church, Cambridgeshire, of lighting and heating by infra-red heaters. Church heating is always difficult because of the height of the roof and the air turbulence but infra-red heating seems to meet the problem. The heaters have been installed in sufficient number to provide general comfort conditions. Another installation of the same kind is to be carried out in the church at Snailwell, near Newmarket, in the near future.

Turbo-Alternator for South Africa

W. H. Allen, Sons & Co., Ltd., have received through the consultant, Mr. J. S. Clinton, an order on behalf of the Municipality of George, South Africa, for a 3,000 kW turbo-alternator with feed heating and condensing plant, etc.

E.W.F. Annual Meeting

The annual general meeting and annual dinner of the Electrical Wholesalers' Federation will be held on Thursday, 24th March next, at the Dorchester Hotel, London.

"Wireless World" Diary

The *Wireless World* Diary for 1960, published by T. J. & J. Smith, Ltd., 12, Hanover Square, London, W.1, in conjunction with the *Wireless World*, is now available (price, leather 6s 3d; rexine 4s 6d; postage 4d). The 80-page reference section includes in condensed form the technical and general information so often needed by radio men but seldom readily available. It includes circuit diagrams (including a general purpose transistor a.f. oscillator and a transistor mixer circuit), coil winding data, aerial dimensions and aerial sharing circuits, licensing regulations, addresses of radio organisations in this country and abroad, world television standards, radar frequency bands, component coding and lists of U.K. television and v.h.f. sound broadcasting stations. The diary also includes tabulated base connections for over 700 valves.

Switchboards for British Railways

Astral Switchgear, Ltd., has recently dispatched four power distribution switchboards for use in connection with signalling and telecommunications installations in the Crewe Railway telephone exchange (Tommy's Lane) and in the sections of line Crewe to Manchester (at Heaton Norris and Edgley) and Crewe to Stafford (at Basford Hall), which form part of the British Railways modernisation programme. They will be brought into use within the next few months. The switchboards are of cubicle construction and incorporate a total of 35 fused switches, d.p. and t.p. in 60, 160 and 300 A ratings, together with the associated metering, contactors, relays and selector switches. Special provision was made to resiliently mount all contactors and relays so as to prevent vibration causing interaction between components. All internal wiring was carried out in single core v.i.r. and polychloroprene compound insulated cable, with a flame-proofed lacquer finish.

Institute of Metal Finishing

The annual general meeting of the Institute of Metal Finishing will be held on 30th November (11 a.m.) at Charing Cross Hotel, W.C.2, and will be followed by a luncheon. In the afternoon Mr. A. A. B. Harvey will be inducted as the new president and will deliver his address on "The Rôle of the Scientific Society."

Induction Heating Equipment for Ordnance Factories

An order for a large installation of induction heating equipment has been secured by the Induction Heating Division of Garringtons, Ltd. It has been obtained in association with Fielding & Platt, Ltd., who are providing the hydraulic press equipment involved. The plant is for the Ministry of Supply Royal Ordnance factories, and has an installed capacity of 3,000 kW.

Education for Productivity

The Central London Productivity Association is sponsoring a meeting to be held on 20th November at the F.B.I., 21, Tothill Street, London, S.W.1, commencing at 2 p.m., to consider the best means of education for productivity. The speaker will be Mr. S. Beer, head of the Operational Research and Cybernetics Departments of the United Steel Companies, Ltd. Tickets (2s 6d for members and 5s for non-members) can be obtained from Mr. D. E. Greene, Department of Production Technology, Northampton College of Advanced Technology, St. John Street, London, E.C.1.

The Association is holding a one-day appreciation course on work study for students, apprentices and management trainees on 1st December at the F.B.I. Tickets (10s each) can be obtained from Mr. R. G. Cattell, hon. treasurer of the Association, 54, Alderney Street, London, S.W.1.

Price Reductions

Burco, Ltd., has reduced the price of the D2 and D2R models of its "Tumblair" tumbler dryers from £53 2s 2d to £49 13s 7d and the D2C model from £53 17s 3d to £50 8s 8d, including purchase tax.

Research & Control Instruments, Ltd., sole distributors in the United Kingdom, announce that the price of the Philips valve voltmeter (type GM 6012) has been reduced from £94 to £70.

Ashley Accessories' Extension

A building extension to house a new drawing office and electrical research laboratory was opened at Ulverston for Ashley Accessories, Ltd., on 28th October. The laboratory includes a cyclic controlled humidity chamber, permitting the stability testing of lampholders and a high power supply with remote control and recording gear for short circuit testing.

Trade Announcements

Scharpf of Stuttgart, who recently introduced into this country a range of washing machines and spin dryers, have announced a comprehensive servicing scheme. Seven main depots have been set up and there will be fifty sub-depots to distribute the spare parts throughout Great Britain. The principal distributors are Denham & Morley, Ltd., 173-175, Cleveland Street, London, W.1.

Cobra (Wood Treatment), Ltd., which specialises in the preservation of overhead line wood poles, has moved to 307, Finchley Road, London, N.W.3 (telephone: Hampstead 8461).

The M-V Heating and Welding Department has been made an integral part of the **A.E.I. Transformer Division.** The business of the Department will continue to be managed by a departmental group committee, consisting of Messrs. G. H. Moule (chief engineer), H. S. Carter (sales manager) and T. R. Porter (superintendent, manufacture). Mr. Moule has been appointed chairman of the group committee.

Wholesale Electrics (Jersey) has moved into new premises at 19, James Street, St. Helier.

Londex, Ltd., has appointed T. Neesham & Co., Ltd., Cumberland House, Hotwells, Bristol, 8 (telephone: Bristol 2-8197), to represent it in South Wales, and Davis & Peters, 19, College Road, Harrow (telephone: Harrow 5578), in Kent and Surrey.

GENERATION and DEVELOPMENT

£2,800,000 Change-over Programme

Electricity supplies to about 75,000 domestic and small commercial and industrial consumers in South Staffordshire and North Worcestershire will be improved when a five-year voltage standardisation programme now being carried out by the South Staffs. and North Worcs. Sub-Area of the Midlands Electricity Board is completed. Details of the programme, which is expected to cost about £2,800,000, were announced at Dudley last week by the sub-area manager, Mr. H. A. P. Caddell, who said that the work had begun in April this year and was already well under way, nearly 10,000 consumers having been changed over so far.

Outlining the plan, Mr. Caddell said that total replacement of the 7 and 2·7 kV networks by a standard 11 kV system would be prohibitively expensive, possibly costing about £8 million, and it would mean wasting assets of about that value still capable of many years of trouble-free service. The plan was therefore to give standard supplies to domestic and other consumers fed from the low voltage mains, to make the maximum use of the existing equipment, and to restrict the growth of the load on the non-standard system—at present about 190 MW—by a gradual transfer to the standard 11 kV system. About 170 miles of new cable would be laid and nearly 300 substations built. The change-over of consumers' apparatus involved about 60 consumers a day for the next five years. In the current financial year the Board was devoting £600,000 to the programme.

Southend Illuminations

The Pier and Foreshore Committee of the Southend Corporation has recommended that an offer by the Eastern Electricity Board to carry out the town's illuminations scheme next year at a cost of £23,086 (subject to a rise and fall clause) should be accepted. In addition, the Committee wishes to purchase direct from Blackpool Corporation set-pieces, etc., to the value of £1,200 for pier illuminations and £498 for the town illuminations.

Floor Warming "Ideal Form of Central Heating"

Speaking at Berkhamsted recently, Mr. H. V. Pugh, chairman of the Eastern Electricity Board, said that it was wrong to consider electricity as just another fuel and to compare it with other fuels solely on the score of the cost. Electricity gave a new and much better way of life. With its aid people could live in homes which were free from dirt and fumes and smell caused by burning some kind of fuel on the premises and they could live in towns which were not polluted by "smog."

Mr. Pugh, who was speaking at an exhibition at the King's Arms Hotel, Berkhamsted, designed to tell builders, architects and local authority officials about electric floor warming and block storage heating, said that people were now demanding a higher standard of comfort in their homes; they wanted greater and more equable warmth when the weather was very cold and they wanted to be able to use the whole of their house and not to hibernate in one room and the kitchen. Electric floor warming was an ideal form of central heating and was particularly applicable to towns with the "new look" provided by centrally situated blocks of flats.

Switchgear for Thorpe Marsh

Associated Electrical Industries, Ltd., has been informed by the Central Electricity Generating Board of its intention to place with A.E.I. a contract for the supply of switchgear for installation at Thorpe Marsh power station, near Doncaster. The equipment will consist of thirteen 275 kV, 15,000 MVA oil circuit-breakers, the first of this rating ordered for installations in Great Britain. The value of the contract will be approximately £1 million.

The new circuit-breakers will control feeders linking Thorpe Marsh to the 275 kV supergrid. They will be manufactured at the Willesden Works of the A.E.I. Switchgear Division and will be generally similar in design to the 330 kV circuit-breakers for the Kariba project.

Refrigerators for Council Tenants

Strong protests are expected from retailers as a result of a Dagenham Borough Council proposal to sell refrigerators on a six-year hire-purchase basis. Although the plan awaits final sanction by the Council, a questionnaire has been circulated among the Council's 4,200 tenants and so far nearly 1,000 have filled in forms applying for either a gas or electric refrigerator. If the scheme is approved, the Council plans to make bulk purchases through the Eastern Electricity Board and North Thames Gas Board.

The appliances would be installed free of charge and maintained free throughout the six-year purchase period. No deposit would be sought, and the weekly charge, varying from 3s 5d to 4s 7d according to the model, would be added to the rent.

Shopping Centre Lighting

Two rows of street lanterns on Malayan kapur timber columns supplied by Siemens Edison Swan, Ltd., are an attractive feature of the new Winston Square shopping centre at Barry, Glamorganshire, which was recently officially opened by the Mayor (Alderman A. G. Thomas). The pole-top "Cathay" lanterns, cast in aluminium alloy, have been carefully chosen to blend with the surrounding architecture.

Siemens Edison Swan "Cathay" lanterns on Malayan kapur columns at the new shopping centre at Barry

Higher Cross-River Power Lines

Following representations from the South Worcestershire coroner, the Midlands Electricity Board has decided to raise all power lines across the rivers Severn and Avon to a minimum height of 45ft. Last July an engineering student was drowned when he dived into the Avon after the 40ft 10in mast of his yacht struck a high voltage line. It was stated at the inquest that some lines over the river had been raised to 45ft in 1954 but at that point the height was 40ft 6in.

OVERSEAS

Floating Power Station

The 15,000-ton British tanker *Stanwell,* which has been laid up at Pembroke Dock for more than twelve months, is to be adapted as a supplementary power station to provide electricity in Norway. The *Stanwell* is reported to have been sold to a Norwegian authority which proposes to buy two or three other similar British tankers.

British Columbian Steam Station

The B.C. Electric Company reports that work has started on its Burrard power station, near Ioco, which will house four steam-driven 211,000 h.p. generating units. The first set is to be put into operation in 1961 and the remaining three units are scheduled to be in service by 1965.

PARLIAMENTARY REPORT

Fuel and Power Policy

Asked to what extent it was his policy to bring together the chairmen of all fuel industries with a view to planning the nation's fuel and power requirements, and avoiding excessive dependence of the national economy upon imported oil and liquid methane, the new Minister of Power, Mr. Richard Wood, said he intended to work in close touch with the heads of the nationalised fuel and power industries on all major issues of policy which affected them.

Nuclear Propulsion for Ships

The sub-committee appointed to make a technical appraisal of the different reactor systems designed for use in merchant ships had presented its report and the Government were considering the recommendations, said the Minister of Transport, Mr. Marples. Asked by Mr. Wall if he would undertake to see that practical tests at sea were carried out as soon as possible, Mr. Marples said he would. Mr. Hay, Parliamentary Secretary, Ministry of Transport, in another reply said the advanced gas-cooled reactor being developed by the Atomic Energy Authority for land application was not, on present information, economic in the smaller sizes required for marine propulsion.

Dounreay Reactor

Asked how far experiments at Dounreay had progressed, the Minister of Education (Sir David Eccles), representing the Minister for Science, said the fast breeder reactor had been undergoing commissioning trials before loading the enriched uranium fuel. These trials had proved more difficult than expected, but this had been due to problems of chemical engineering and not to nuclear problems. Enriched uranium was now being loaded and was expected to approach a critical state within the next few weeks.

Atomic Energy Authority Bill

The Bill to increase the maximum number of members of the United Kingdom Atomic Energy Authority, and to enable the Authority to include in its pension schemes the staff of the National Institute for Research and Nuclear Science, was presented and read a first time.

Power Line Over School Grounds

Concern was expressed by Mr. Parker at the routing of a "dangerous power line" through the grounds of the Camphill-Rudolf Steiner School for children in need of special care at Murtle House, Aberdeen, instead of through the little-used Den of Murtle. The Secretary of State for Scotland, Mr. Maclay, said he had been discussing the matter with the North of Scotland Hydro-Electric Board. He understood the School had commenced an action for interdict against the Board and as the matter was before the courts it would be improper to comment at this stage.

Ministry of Aviation's Responsibilities

In a written reply to Mr. Mason, the Prime Minister stated that among the responsibilities of the new Ministry of Aviation would be guided weapons, ballistic missiles, atomic weapons, radar and other electric equipment. This followed the abolition of the Ministry of Supply.

Exhibition Facilities in London

Asked by Mr. Nabarro what action he proposed to take on the report of the Federation of British Industries stressing the urgent need for a new exhibition building in London, the President of the Board of Trade (Mr. Maudling) said he was considering the proposals but it was too early to express a considered view on them.

Electricity and Nationalisation

Replying to critics of nationalisation, Mr. R. E. Prentice said the Labour Party should remind the nation that some of the outstanding successes in British industry today were in the public sector. There was no industry in Britain with a more spectacular record of expansion than the electricity industry and hardly any industry in Britain had raised its prices less in the last 10 years. The nation should also be reminded that the atomic energy industry had led the world in the commercial use of atomic power and that it was a nationalised industry. The Labour Party should reiterate its belief in public ownership, he said. The British economy permanently required a large degree of public planning and that public planning should include the ownership by the nation of the basic industries.

Unofficial Strikes

Commenting in the House of Lords on unofficial strikes, Lord Citrine, former chairman of the Central Electricity Authority, said no one was more troubled about the epidemic of these strikes than the union official. The strikes were vexatious and irritating; they were discrediting to the unions and endangered the agreements between unions and employers. He did not think the average man or woman in the workshops ever thought it possible that employers might refuse to negotiate and make agreements with the unions if afterwards they were flagrantly broken. But with his memory of what had happened in the days before industrial relationships were so intimate, he did not exclude that possibility. At the same time the numbers affected were small. Britain had had nothing like the steel strike in the United States for 33 years. The T.U.C., which had embarked on one of the most serious inquiries in its history, would deal with unofficial strikes in a genuine, thorough spirit.

Priest Rapids Scheme Inaugurated

To mark the occasion of the first supply of power from the Priest Rapids hydro-electric station to the Pacific North-West Coast distribution system, a ceremony was held at the station on 30th October by the Commissioners of Public Utility District No. 2 of Grant County in the State of Washington, U.S.A.

The Priest Rapids contracts, valued at some $30 million, were secured in 1956 by the English Electric Export & Trading Co., Ltd., in conjunction with the Merritt-Chapman & Scott Corporation, New York. For these contracts, the English Electric Co. is supplying ten 114,000 h.p. water turbines and generators and five 183,000 kVA transformers to raise the generating voltage of 13·8 to 230 kV for transmission to the various consuming centres. The equipment was designed and is being manufactured mainly at English Electric's Stafford, Rugby, and Netherton works; two of the generators are already in commercial service.

The Priest Rapids project is one of a chain of stations being built to harness the power of the Columbia River system. The water turbines are of the vertical Kaplan type with a nominal rating of 114,000 h.p. at a 78ft head but capable of producing 131,000 h.p. at 84ft head. The vertical umbrella type generators each have a nominal output of 83,000 kVA at a speed of 85·7 r.p.m. but are capable of producing 95,500 kVA, the power factor being 0·95 in both cases.

Nickel-Steel Magazine

The latest edition of "Inco-Mond Magazine" (No. 11) includes articles on the uses of nickel steels in the Napier "Deltic" high-speed diesel engine, the use of "Cronite" pots and boxes to cut the costs of heat-treating operations, temperature measurement by platinum-rhodium thermocouples, a nickel-cadmium battery for aircraft, and a historical survey of the uses of copper. The magazine is obtainable free on request to the Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1.

B.E.A.M.A. PUBLICITY CONFERENCE

Discussion of a Variety of Subjects

THIS year, for the first time, representatives of the Press were invited to attend the B.E.A.M.A. Publicity Conference held at the Connaught Rooms, London, on 3rd and 4th November. The Conference, the fourth of its kind, was attended by approximately 200 publicity representatives from the B.E.A.M.A. member-firms, who were welcomed by the chairman, Mr. C. T. M. Bagnall (English Electric Co., Ltd.).

At the opening session, when Mr. D. G. Denoon (B.I. Callender's Cables, Ltd.) presided, the speaker was Mr. Walter Nurnberg, the well-known commercial photographer, who stressed the importance of good lighting in photography and warned against the dangers of over-dramatising a subject. On the question of works photography, he suggested that this might well be improved if managements considered raising the salaries of their staff photographers. Techniques to be observed in the use of cameras and film making were also dealt with and photographic slides were used to give examples.

House Journals

The second session dealt with "The Role of House Magazines in Industry" the chairman being Mr. H. H. Lusty (Central Information Department, A.E.I., Ltd.), and the speaker Mr. Bryan Samain (Cementation Co., Ltd.). This subject provided a topic for much lively discussion as many of the audience were themselves personally concerned in the production of house magazines. Mr. Samain said that the object of house journals varied from one organisation to another and no one knew for certain just how many there were. The four essentials, he said, were a clearly defined policy; a clearly defined readership; a sound editorial policy; and good presentation. He was of the opinion that too little attention was paid to the basic needs of house journals. If more intelligently presented they would make more impact—far too many had the same standard and humdrum approach. He examined the roles of both categories — internal and external — remarking that internal journals were often inferior productions compared with their external counterparts. His major criticism was that they were too often of similar appearance and mainly text-only publications; more pictures were needed. Many of the external house magazines were well produced, but he deplored the presentation of several of the technical journals. Electrical house journals, said Mr. Samain, ranged from the consistently good to the outrageously bad. Finally, he made a plea for editorial freedom.

In the discussion that followed, Mr. M. B. Schroeder (English Electric Co., Ltd.) asked if the speaker believed in the free distribution of house magazines. Mr. Samain replied that, in the main, a charge should be made—however small. The charge did mean that the reader was not having it "rammed down his throat."

Mr. S. H. Pryor (Brookhirst Igranic, Ltd.) was informed, in reply to a question, that politics were dangerous, while Mr. J. Read (Standard Telephones & Cables, Ltd.) thought it was not considered a good idea to attempt to procure advertising in house journals. On the question of whether it was preferable to post house magazines direct to the homes of employees or to distribute them in the works, Mr. W. A. Wells (Electric Construction Co., Ltd.), the questioner, was told that posting might again be a case of "ramming it down their throats" and nothing should be done without consent. In reply to a question from Mr. W. S. Boone (Johnson & Phillips, Ltd.) Mr. Samain said that it was wrong not to pay employee contributors to house magazines. Mr. Samain concluded his lively and most informative address with his own ideas of a good house magazine, advocating an 8 by 11in format, clear contents, a good opening story and plenty of works news. It should not, he said, be a dull picture of plant without people, but something to reflect industry's life at work and play.

The afternoon session opened with a "Brains Trust" which dealt with the subject of editorial information. The panel consisted of Mr. R. Baldwin (*Electrical Times*), Mr. B. Mycock (B.B.C. Industrial Correspondent), Mr. R. Jokel (London Correspondent, Dutch Broadcasting Corporation) and Mr. H. McLeave (*Daily Mail*). Mr. W. L. Allison (Lancashire Dynamo & Crypto, Ltd.) was in the chair. Questions came from all parts of the hall and during the course of an hour advice was given to a

Personalities at the B.E.A.M.A. Publicity Conference luncheon (left to right): Col. B. H. Leeson, Mr. C. T. M. Bagnall, Mr. S. F. Steward, Mr. G. M. C. Peacock, Mr. V. C. Marciandi, Mr. W. M. Tribute, Mr. A. H. Edney, Mr. A. St. J. Shuttleworth, and Mr. A. C. V. Clarkson

hypothetical young man wishing to enter the editorial section of a publicity department of an engineering firm. The general consensus of opinion of the panel was that the term " information officer " was preferable to " Press officer " or " publicity officer "—indeed, Mr. Jokel said that foreign journalists were very allergic to the word " publicity." Mr. McLeave, asked whether editors were happy about industrial features and supplements which reduced newspaper editorial space, said that he was not too keen on the idea, but did not think that they took advertising away from the trade and technical Press. At this point Mr. A. C. V. Clarkson (G.E.C.) said that he received about a thousand approaches a year to take part in newspaper supplements.

News conferences, the panel decided, were necessary functions in that additional questions could be asked and contacts could be made, but Mr. McLeave stressed that it was necessary to make certain that there was news if a news conference was called. The panel agreed that public relations agencies were equally as good to deal with as the Press officers of individual firms, providing the news was there. It was pointed out, however, by Mr. Baldwin, that the work of the Press officer was internal, while the outside public relations officer often had easier access to top level management.

For the final session of the day delegates were invited to " ride their hobby horse." Volunteers were allowed to speak for not more than three minutes on a subject of their choice, followed in each case by time for general discussion. Mr. P. J. J. Roberts (Berry's Electric, Ltd.) ably steered the jockeys along the course. A variety of topics were discussed, including safeguarding the consumer, in which it was recommended that it was well worth while to state the consumers' interest when advertising; doubtful advertising media; and exhibition facilities in the United Kingdom. Dealing with this last subject, Mr. C. H. Alsop (W. H. Allen, Sons & Co., Ltd.) said that all were familiar with the tragic story of exhibition facilities in this country, particularly after the breakdown of the British Industries Fair. He also expressed concern at the number of firms which were unavoidably shut out of the ground floor of the A.S.E.E. Exhibition on account of the limited space, newcomers being relegated to the gallery. Still on the subject of exhibitions, Miss H. S. O'B. Hoare (Transformers (Watford), Ltd.) complained of the high costs of exhibitions and stand fitters' charges and of trade union threats to exhibitions.

The first day's proceedings concluded with an informal dinner, held at the Connaught Rooms.

Trade Exhibitions

At the fifth session on the following morning, Mr. W. J. Marrable, formerly exhibition manager of Imperial Chemical Industries, Ltd., and a member of the F.B.I. Committee of Inquiry into U.K. Exhibition Facilities, made a critical survey of exhibitions. He said that in pre-war years 2,000 sq ft of space at the Birmingham section of the British Industries Fair cost £1,522 and 360 sq ft at the corresponding exhibition in London cost £350. There was, he said, a much more practical approach to design and display problems today. The standard was high and it was up to exhibitors to maintain that standard. He deplored the mushroom growth of the exhibition calendar, saying that today there were too many exhibitions. He thought that many which were held annually would be better if held biennially. He did not think that the B.I.F. would ever return and said that the preference of industry was for specialised shows. He mentioned the growing interest of publishing houses in exhibitions and said that there were no fewer than twelve which were at the present time organising exhibitions relating to their own field. He did not view this matter with concern, adding that publishers were more inclined to work with the trade associations, resulting in a better effort.

Dealing with overseas exhibitions, Mr. Marrable said that the number of international fairs continued to grow. Last year there were 58, mainly in Europe. International fairs, however, were not comparable with what we knew as sound trade fairs, such as the A.S.E.E. Exhibition, but were more centres of public entertainment. The Hanover Fair, for example, had 4½ million visitors in ten days. Slides were shown of the Hanover, Milan and Paris Fairs. He made a brief reference to the F.B.I. report on exhibitions, drawing attention to the recommendation that a new exhibition centre should be erected, near to the centre of London, as soon as possible. Heavy industry was not at present satisfied with present exhibition facilities—there was not enough solid floor space. At least 4,000 sq ft was required and, at present, was just not available. Looking to the future, Mr. Marrable said that there must be a rationalisation of the exhibition programme, even if it meant an amalgamation to produce fewer shows. He spoke of the growing foreign participation in British shows, quoting as an example, the new name of the British Plastics Exhibition —" Interplas."

Again the question of trade union restrictive practices at exhibitions cropped up during the discussion period but the general feeling was that exhibitors would just have to submit and make the best of it. Other questioners queried the rising costs of exhibitions and the poor catering facilities which at present existed.

Overseas Publicity

The sixth and final session took the form of a discussion on " Publicity Overseas." Messrs. A. C. V. Clarkson (G.E.C.), V. P. Marciandi (Electrical Division of Radiation, Ltd.), W. M. Tribute (formerly with Hoover, Ltd.) and A. St. J. Shuttleworth (Commonwealth and East Asia Department, F.B.I.) formed the panel and Mr. A. H. Edney (Electrical Division of Radiation, Ltd.) was chairman. The best method of controlling overseas advertising was first discussed and much useful information emanated from the panel. Mr. Clarkson advised that a representative should be sent to the territory to be covered so that the market situation could be first ascertained. The Central Office of Information could help a British manufacturer to spread his story overseas in many ways, he said, and in this he was supported by Mr. Shuttleworth. Mr. Marciandi, however, thought that while the C.O.I. might be excellent for selling atomic power stations and the like, they were not able to help with regard to selling washing machines. Where only a limited amount of advertising was being considered for the overseas market, Mr. Shuttleworth suggested that manufacturers should concentrate on catalogues. Everything, however, should be in the language of the country concerned, but another panel member thought that English, which was becoming more and more recognised as a universal language, should be preferred.

At this stage, the value of the trade and technical Press as an advertising medium abroad came under fire. It was suggested that, despite their overseas circulation figures, little was done for the manufacturers in the way of advertising. Mr. Clarkson did not think it beyond the capabilities of the British Press to produce something

along the lines of *Life* magazine. In defence of the Press, Mr. B. W. Browne (Hackbridge & Hewittic) said that a number of journals did have a large overseas circulation, but they were governed by the advertising revenue received. In this he was supported by Mr. F. R. Page (Lincoln Electric Co.) who thought that in any case advertising rates would be too high in a publication such as *Life* magazine.

The last word came from Mr. Bagnall who, in a short speech at the conclusion of the conference sessions, said that the Press was still the most important medium through which advertisers could express themselves.

The conference proper was concluded with a luncheon at which Mr. Bagnall presided and introduced Col. B. H. Leeson as the guest speaker. Col. Leeson, who recently retired from the position of director of B.E.A.M.A., took the opportunity of expressing his thanks to the Publicity Department and referred to the excellent work that it had done during the past thirteen years, mentioning in particular the production of the "B.E.A.M.A. Catalogue" and work in connection with the Brussels Fair. In this connection he paid special tribute to Mr. Sam Black, organiser of the Electrical Section in the British Industrial Pavilion. Had the electrical industry not supported the industrial display, said Col. Leeson, the British manufacturers' representation would indeed have been very poor. A lot had been learned from the conference, he said, and the industry had got to look ahead. Changes were not to be feared. Referring to points in the Queen's Speech which were vital to the electrical industry, Col. Leeson applauded the establishment of a Minister of Science. The electrical industry, he said, would benefit from the capital which was now going into other industries, but warned that industry could only progress if the banking industry kept pace. On the question of free trade, he said, we had not as yet a clear conception, but the electrical industry would have to be on its toes to meet the competition, particularly from Germany, which all meant more trade at home—which was easy, and more trade overseas—not so easy. More virile marketing and publicity was advocated.

Mr. S. F. Steward (director of B.E.A.M.A.) proposed a vote of thanks to Col. Leeson for his speech and for his outstanding services to the industry.

PRIVATE NUCLEAR REACTOR

The Duke of Edinburgh Inaugurates "Merlin"

LAST Friday, H.R.H. the Duke of Edinburgh opened the first British privately-owned research reactor at the Fundamental Research Laboratory of Associated Electrical Industries, Ltd., at Aldermaston Court. The reactor was built by the A.E.I.-John Thompson Nuclear Energy Co., Ltd., and was described in the *Electrical Review* of 4th September last. It is a pool type reactor with a light-water cooling system and moderator. The fuel is 93 per cent uranium 235 which is supplied from Dounreay.

In a short speech before unveiling a commemorative plaque on the side of the reactor, the Duke said that at present there was no great rush for other countries to buy nuclear reactors, but when the time came, only those countries and companies with considerable practical experience, as opposed to theoretical knowledge, would be able to produce the goods. History had shown that large sudden jumps into relatively unknown techniques had nearly always ended in disappointment. The only certain way to success was a series of relatively small advances and the gradual building up of skill and experience. That process was going on steadily in the development of reactors in Britain. He also stressed that the work being carried out at Aldermaston was not a duplication of the work of the United Kingdom Atomic Energy Authority.

The Duke of Edinburgh, with Lord Chandos, being shown a fuel element for the Merlin reactor

Heating Symposium

AT the Dorchester Hotel, London, on 29th October a symposium on the subject of heating was held by the Copper Development Association. Some 230 invited members of the many professions, trades and industries engaged in the design, manufacture and installation of all types of heating systems were present.

Under the chairmanship of Dr. M. Cook, C.B.E., chairman of the Metals Division, Imperial Chemical Industries, four papers were presented. These were "Heating Problems from the Architect's Point of View," by K. Allerton, A.R.I.B.A. (County Architect's Department, Nottingham); "Panel Heating," by D. Rudd, B.Sc., M.I.E.E.; "Electrical Floor Warming," by E. M. Ackery, B.Sc. (E.D.A.); and "Small-Bore Heating," by E. Carr, Ph.D. (Copper Development Association).

The advantages and applicability of each of the three types of systems were the subject of considerable discussion. Typical points raised included the necessity for providing economical means of increasing the normal comfort level of warmth to meet increased temperature demands under varying conditions at different periods, closer liaison between the smaller architect and heating engineer, and suggestions that electrical heating should no longer be considered as a separate branch of heating engineering.

During the luncheon recess those present were able to inspect a display of small-bore, panel and electrical floor warming heating systems using copper tube or copper mineral insulated cable.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. T. G. Ellison and **Mr. A. E. Skan** have been appointed joint managing directors of George Ellison, Ltd.

Mr. Ellison is a son of the founder of the company, the late Mr. George Ellison, and has been a director since 1929. He was elected chairman of this and of the associated companies, Alfred Ellison, Ltd., and Tufnol, Ltd., in 1955.

Mr. Skan has been a director of all three companies since 1944 and is managing director of Tufnol, Ltd. He is a past-chairman of the British Plastics Federation, a member of the

Mr. T. G. Ellison

Mr. A. E. Skan

Grand Council and the Midland Regional Council of the Federation of British Industries, the Council of the British Electrical and Allied Manufacturers' Association, and the Council of the Association of Short Circuit Testing Authorities.

Mr. R. Ferguson, O.B.E., general manager since 1947 of the Marconi International Marine Communication Co., Ltd., has been elected to the board and now becomes managing director of the company. **Mr. F. N. Sutherland,** C.B.E., M.A., M.I.E.E., who has long been associated with the Marconi group, is also elected to the board of Marconi Marine.

Consequent upon Mr. Ferguson's appointment, **Mr. D. P. Furneaux,** M.A., B.Sc., is promoted to the post of general manager of the company and **Mr. J. Keir** is appointed personal assistant to the managing director.

The Eastern Region of British Railways announces the appointment of **Mr. J. W. Grieve,** B.Sc., M.I.E.E., formerly assistant electrical engineer (new works), Chief Mechanical and Electrical Engineer's Department, Eastern and North Eastern Regions, as electrical engineer (new works), in the Department of the Chief Mechanical and Electrical Engineer, Eastern Region.

Mr. Grieve was educated at Edinburgh University and Heriot-Watt College, Edinburgh, and after training with the Metropolitan-Vickers Electrical Co., Ltd., he joined the company's Traction Erection Department in London and was engaged on installing and testing equipment for the London Underground and Southern Railways. In 1926 he was appointed assistant electrical engineer on the Bombay-Baroda and Central India Railway for the inauguration of their electric suburban services in Bombay. He entered the service of the L.M.S.R. in 1930 and was concerned with the preparation of electric traction projects and technical investigation into electric rolling stock, becoming assistant (electric traction) to the chief mechanical and electrical engineer, London Midland Region, in 1949. In 1950 he was appointed assistant (schemes and calculations) in the newly formed Electrical Engineering New Works and Development Section of the Railway Executive and in 1951 was made electrification engineer, responsible to the executive officer, Electrical Engineering New Works and Development Section, British Transport Commission, for electrification schemes in the Eastern and North Eastern Regions. He was appointed to the position he is now relinquishing in 1956.

Mr. C. F. Rose, B.Sc.(Eng.), A.M.I.Mech.E., M.I.P.E., M.I.Loco.E., formerly production and works assistant to the chief mechanical and electrical engineer and the carriage and wagon engineer, Eastern and North Eastern Regions, Doncaster, has been appointed mechanical and electrical engineer (development) in the Department of the Chief Mechanical and Electrical Engineer, Eastern Region, at the headquarters office of the department in London.

Mr. H. Brierley, liaison and personnel officer of the Eastern Electricity Board, has retired and a presentation on behalf of the staff was recently made to him by Mr. H. V. Pugh, chairman of the Board. Mr. Brierley was educated at Oaks Institute, Liverpool, and obtained his technical training at Wigan Technical College. After service in the Royal Navy in the 1914-18 war he held positions with the Lancashire Electric Power Co., the Yorkshire Power Co. and Croydon Corporation. From 1937 to 1948 he was the chief engineer and manager of the Hampstead undertaking.

Mr. W. A. Galbraith, B.A.(Eng.), M.A.(Cantab.), A.M.I.Mech.E., has been appointed general sales manager of the Yale & Towne Manufacturing Co.'s British Materials Handling Division at Wednesfield, Staffs. Two promotions within the Division have been made concurrently with this appointment: **Mr. H. Davis,** assistant sales manager (United Kingdom), has been appointed sales manager (United Kingdom) and **Mr. M. J. Stuart,** assistant sales manager (export), has been appointed sales manager (export).

Mr. J. E. Robinson, M.I.Mech.E., M.I.Mar.E., chief engineer of Hepworth & Grandage, Ltd., has been appointed to the board of directors. He will continue as chief engineer.

Mr. T. L. Booth, previously director and general manager of Hepworth & Grandage (Yeadon), Ltd., has been appointed to the board of Hepworth & Grandage, Ltd., the parent company, and will take up responsibility at its main St. John's factory at Bradford. Mr. Booth remains on the board of Hepworth & Grandage (Yeadon), Ltd. **Mr. H. Forrest,** director and works general manager of the Hepworth & Grandage main factory at Bradford, has been appointed to the board of Hepworth & Grandage (Yeadon), Ltd., and the general managership of the Yeadon factory, previously the responsibility of Mr. Booth, will now be taken over by **Mr. A. Rowntree,** who will be assisted by **Mr. E. Boyes.**

Mr. K. R. Simmonds, B.Sc.(Eng.), A.M.I.E.E., has been appointed general manager of the International Rectifier Co. (Gt. Britain), Ltd., Oxted, Surrey. Before joining the company Mr. Simmonds had been for two years general manager (marketing) of Texas Instruments, Ltd., Bedford. He was previously with Elliott Bros. (London), Ltd., whom he joined in 1948, and was manager of their Radar Division at Rochester.

Mr. K. R. Simmonds

A number of new appointments are announced by Rotaflex (Great Britain), Ltd. **Mr. J. Naylor** is appointed sales manager, **Mr. G. Jacobs,** who for the past four years has been with Stamm & Partners, Ltd., is appointed export sales manager, **Mr. R. Klein,** who joined Rotaflex earlier this year, will take charge of the Architectural and Display Lighting Division, **Mr. H. Myers** becomes sales organiser, and **Mr. R. Howells** is appointed works manager, in charge of the factory in North London. He will have as his production manager, **Mr. B. Stone. Mr. L. U. R. Zucchi,** previously a consultant designer for the development section of la Rinascente of Milan, will head the Rotaflex Design and Development Division.

Mr. J. W. Meredith, managing director of Huntington, Heberlein & Co., Ltd. (a subsidiary of Simon-Carves, Ltd.), has been appointed a director of Simon-Carves, Ltd.

Mr. R. C. Jones, representative of W. T. Henley's Telegraph Works Co., Ltd., in the London area, recently received a gold watch for forty years' service. It was presented to him by Mr. H. D. Parsons, general sales manager, in the presence of a number of his colleagues, in the company's Engineering Sales Department, High Holborn, London.

Mr. F. C. Braby, M.C., D.L., M.I.Mech.E., chairman and managing director of Fredk. Braby & Co., Ltd., has been elected chairman of the Council of the British Non-Ferrous Metals Research Association to succeed Dr. M. Cook, C.B.E., who retires from office on 31st December next.

Mr. F. Burgess (Whites-Nunan, Ltd.) has been elected chairman of the British Valve Manufacturers' Association for the year 1959-60. **Mr. J. W. Plowman** (Dewrance & Co., Ltd.) has been elected vice-chairman.

Mr. H. Slack has been appointed to the board of Kelvin & Hughes (Industrial), Ltd., as sales director. He was formerly technical sales manager.

Mr. J. Firth has been appointed manager of the Mechanical Handling Division of Robert Dempster & Sons, Ltd., Elland, Yorks. Mr. Firth was formerly sales manager of the Surface Division of Richard Sutcliffe, Ltd., Horbury, with whom he had been associated for twenty years.

Mr. F. S. Boddington, district engineer, Southport District, Merseyside and North Wales Electricity Board, retired on 30th October after forty-six years' service in the electricity supply industry.

Nearly 150 members and guests of the **Lightmongers' Society** met at the annual dinner of the Society on 3rd November. This year it was held in the Livery Hall of the Guildhall, a very handsome and dignified setting. After dinner the toast of "The Society" was proposed by Mr. A. E. Iliffe who mentioned that it was formed in 1953. Inquiring into the origin and meaning of the term "monger," he quoted one of Samuel Johnson's definitions of "mongers" as "jovial fellows." The principal function of the Society was to foster fellowship and good feelings in the lighting industry. In his response, Mr. J. E. Lane, the president, said that membership was not confined to electrical men; there was one "gas" member and the Society was open to others in the lighting industry. Proposing the health of the guests, Mr. H. P. Walker thought that few industries possessed such an organisation as the Lightmongers and the guests would be impressed by the spirit which existed among the members. Mr. G. F. Cole replied to the toast. Mr. V. G. E. Gardner proposed the health of the president and said that Mr. Lane had now retired after spending forty-five years in the industry. After responding, Mr. Lane handed over a cheque for the E.I.B.A. to Mr. D. R. Quinn and then invested Mr. Gardner, his successor, with the president's badge.

Mr. J. E. Lane inducts Mr. V. G. E. Gardner as president of the Lightmongers

Among the awards of medals recently made by the president and the Council of the Royal Society is the Hughes Medal to **Dr. A. B. Pippard,** F.R.S., reader in physics in the University of Cambridge, for his distinguished contributions in the field of low temperature physics.

Members of the Birmingham Centre of the **Illuminating Engineering Society** were guests of the City of Birmingham at a reception, followed by a buffet supper and dancing, given by the Lord Mayor, Alderman J. H. Lewis, in the Council House, Birmingham, on 6th November. Over 250 guests attended the function which was the culmination of the Centre's activities celebrating the I.E.S. Golden Jubilee this year. During the evening the guests were able to visit the art galleries in the Council House. Alderman Lewis, in a speech welcoming the I.E.S. as a corporate body, referred to the fact that this year was also the 21st anniversary of the Birmingham Centre. The chairman of the Centre, Mr. J. R. Yeates, and the national president of the Society, Mr. H. G. Campbell, replied.

Mr. J. R. Thomas has retired from the Plessey group of companies after twenty-seven years' service. He was at one time general manager of the Plessey Kembrey Street factory, Swindon, and later director of the Amar Tool & Gauge Co., Ltd., Chadwell Heath. He has worked in a technical advisory capacity with Amar since 1957.

Mr. P. Deriaz, Dip.Mech.E. (Zürich), author of the article on "Kaplan and Deriaz Turbines" (page 647), was educated at the State School in Geneva and the Federal Institute of Technology in Zürich where he obtained the diploma in hydraulic machinery in 1921. He spent a further year at the Institute as assistant lecturer in mechanics before joining the English Electric Co. in 1922 as first assistant designer in the Hydraulic Department. Mr. Deriaz was appointed chief designer of the Water Turbine Department in 1950, and some of his principal work in recent years has included the design of the Bersimis I water turbines, the 16 Canadian turbines of the St. Lawrence power house and the ten Kaplan turbines for the Priest Rapids on the Columbia River. His most noted work is connected with the mixed-flow

Mr. P. Deriaz

At the I.E.S. reception in Birmingham (left to right): Mr. H. G. Campbell (president, I.E.S.), Mrs. Campbell, the Lord Mayor, the Lady Mayoress, Mrs. Yeates and Mr. J. R. Yeates (Birmingham Centre chairman). At the rear are Mr. C. Willdey (hon. secretary, Birmingham Centre) and Mrs. Willdey

variable-pitch turbines and pumps which bear his name and came into service in 1957 at the pumped storage scheme of the Sir Adam Beck Niagara power plant of the Hydro-Electric Power Commission of Ontario.

The annual dinner of the foremen's section of the staff association of the **Telegraph Construction & Maintenance Co., Ltd.,** and **Submarine Cables, Ltd.,** was held at the Shakespeare Hotel, Woolwich, on 6th November, those present numbering over 130, including several foremen pensioners. Mr. W. F. Randall, managing director of the Telcon Metals Group, replied to the toast of the company proposed by Mr. C. Rudd (superintendent, general services) and Mr. A. D. Lidderdale (Greenwich works manager) replied to the toast to the guests proposed by Mr. H. May (power cables quality inspector).

Mr. H. P. Sale (sales manager) and **Mr. R. C. Coombs** (deputy sales manager) have resigned from M.K. Electric, Ltd. **Mr. G. A. Ruff** has been appointed sales manager (home) as from 16th November.

Mr. D. G. Hill has been appointed manager of the Air Filter Department of Air Control Installations, Ltd. He has been with the company for over twelve years, and was appointed assistant manager, Filter Department, some eighteen months ago.

The dinner and presentation of awards to members of the E.C.C. St. John Ambulance Division and the Fire Brigade was held on 30th October at the staff dining hall of the **Electrical Construction Co., Ltd.,** Wolverhampton. The chief guests were the Mayor and Mayoress of Wolverhampton, Alderman N. F. Bagley and Mrs. Bridgewater, and the awards were presented by the Chief Constable, Mr. N. Goodchild.

The annual ball of the **Ipswich and District Electrical Association** was held at the Royal Hotel, Clacton-on-Sea, on 6th November and was attended by some 230 members and their guests. Following tradition, no speeches were made. The loyal toast was given by the chairman, Mr. J. A. Robertson (assistant chief engineer, Bexford, Ltd.). Among those attending were Mr. H. V. Pugh (chairman, Eastern Electricity Board), Mr. C. C. Scott (joint managing director, Electrical Components, Ltd.), Mr. E. Mead (regional manager, A.E.I. Group) and Mr. C. H. Broughton Pipkin (commercial manager, British Insulated Callender's Cables, Ltd.).

Mr. H. V. Pugh and Mr. J. A. Robertson with their ladies at the annual ball of the Ipswich and District Electrical Association

Mr. P. A. Moore, Associate I.E.E., has entered private practice as a consulting engineer. He has for the last twenty-one years been chief electrical engineer for Messrs. E. G. Phillips, Son & Partners, consulting engineers, Nottingham. Educated at the Wandsworth Technical Institute and Battersea Polytechnic, his initial training was received in the head office of the General Electric Co., Ltd., from 1927 to 1935, after which he joined the staff of Messrs. J. Stinton Jones & Partners, consulting engineers, London. Mr. Moore is a past-president of the Nottingham Electrical Club and past-chairman of the East Midlands Section of the I.E.S. His private address is Fourways, The Square, Kinoulton, Notts.

Mr. P. A. Moore

Wickman, Ltd., announce the appointment of **Mr. R. J. Dixon** as director and general manager of their Machine Tool Manufacturing Co.

Mr. J. M. Barker, district commercial engineer, Morpeth, of the North Eastern Electricity Board, has retired after thirty-five years in the electricity supply industry.

The annual dinner of the London Branch of the **Electrical Contractors' Association,** held last Friday at Grosvenor House, London, W., was a very happy occasion. Apart from "The Queen," there was only one toast, that of the guests. It was proposed by Mr. G. F. Bedford, chairman of the Branch, in a lighthearted way and the response was by Mr. V. J. Stock, president of the E.C.A. In the course of his remarks Mr. Stock again referred to the inducements offered to contractors by some manufacturers to buy their products. He considered that stability in the industry was of more importance to contractors than extra discounts. The dinner was followed by a dance, during which there were demonstrations of ballroom dancing by four experts in the art.

The annual general meeting of the **Electrical Trades' Commercial Travellers' Association** will be held on 20th November at the Feathers Hotel, The Broadway, Westminster, S.W.1. The business session will be preceded by a supper (6 for 6.30 p.m.). Applications for seat reservations for supper should be made to Mr. F. J. E. Simons.

Mr. J. B. Scott, sales director of Crompton Parkinson, Ltd., left London on Wednesday for New York where he is to address a meeting called by the American Management Association today (Friday). His principal subject will be the Anglo-Soviet Trade Agreement.

About 150 members and guests were in attendance at last Tuesday's luncheon meeting of the **Electrical Industries' Club** when the president, Mr. C. Robertson King, spoke of the "Trials and Tribulations of a Football Club Director." Mr. King, who is president and chairman of Derby County Football Club, was supported by Mr. Harry Storer, the Club's manager. The next meeting will be on Tuesday, 8th December, when the occasion will be the annual Christmas luncheon.

The annual dinner of the **Old Centralians** was held on 9th November at the Grocers' Hall, London. The loyal toast was proposed by the president, Mr. J. D. Peattie, C.B.E., F.C.G.I. Mr. P. J. C. Bovill, J.P., the Master of the Company of Cutlers in Hallamshire, referred to the urgent need for more graduate engineers to work on research and development. Speaking of his associations with Sheffield, he remarked that cutlery was not the only product and alloy steels were now being produced in quantity. Mr. Bovill then proposed a toast to the Old Centralians and the City and Guilds College, which was responded to by the president. Mr. R. A. Rubinstein, M.C., T.D., A.C.G.I., in a witty speech proposed the toast to the guests, which was responded to in like manner by the Rt. Hon. W. R. Milligan, Q.C., M.P., Lord Advocate.

OBITUARY

Mr. Frederick Newton, M.I.E.E., M.I.Mech.E., whose death we briefly reported in our last issue, was from 1915 to 1947 technical director and subsequently to 1955, technical consultant of Newton Brothers (Derby), Ltd. He was the last of five brothers, three of whom established as a private concern in 1899 the forerunner of the present organisation at Alfreton Road, Derby. Mr. Newton was the inventor of many patents owned and developed by Newton Bros. (Derby), Ltd., of which probably the best known is the

Newton-Derby automatic carbon pile voltage and current regulator. He was the designer of the first lightweight aircraft wind driven generator of British design, produced at the end of the 1914-18 war, and of very many subsequent electrical machines of specialised types for all the defence services in particular as well as for many other applications of a non-standard character for the Post Office, the B.B.C., British and overseas railways and industry generally.

Mr. Alfred George Wilson, production manager of Laurence, Scott & Electromotors, Ltd., died on 30th October at the age of forty-nine. Mr. Wilson was apprenticed at the company's Norwich works in 1926, and subsequently became service manager (1942) and production manager (1945). Mr. Wilson was not related to Mr. G. H. Wilson, the managing director of the company.

Mr. George Henry Cook, Lincoln district engineer to the East Midlands Electricity Board, has died in Lincoln County Hospital at the age of sixty-three. He went to Lincoln from Bolton in 1928 as assistant electrical engineer to the Corporation. In 1939 he became deputy electrical engineer and manager, a post he held until he became district engineer when the industry was nationalised.

Mr. B. C. Elliott, manager of the factory at Calne, Wilts., of C. H. Blackburn & Co., Ltd., died suddenly on 6th November. Mr. Elliott had been with the company for more than twelve years and for some years he had been a member of the Calne Council, being Mayor for two years in succession.

Mr. J. S. Carter, director of Chamberlain & Hookham, Ltd., died suddenly on 5th November at his home in Sussex at the age of seventy-one. He retired from active duties in 1957 after fifty years with the company, twenty-one as managing director.

Mr. John Clayton Laing, Derby area manager of the St. Helens Cable & Rubber Co., Ltd., since 1949, died on 29th October. Before joining the St. Helens Co. he was with the Hardy-Pick Co., Sheffield, and was also for many years chief electrician and engineer at the Denby Colliery.

Mr. E. W. L. Cowan, managing director of Landis & Gyr, Ltd., died on 31st October.

WILLS

Sir Duncan Watson, J.P., M.I.E.E., founder of Duncan Watson Electrical Engineers, Ltd., a member of the Central Electricity Board from 1927-48, a former member of the North of Scotland Hydro-Electric Board, and a director of a number of companies, who died on 27th September last, left £1,414,116 gross (£1,374,463 net). Among his bequests he left £1,000 to the Benevolent Fund of the Institution of Electrical Engineers.

Mr. T. L. Eckersley, B.A., B.Sc., Ph.D., F.R.S., M.I.E.E., radio research worker and former senior research physicist, Marconi's Wireless Telegraph Co., 1919-46, who died on 15th February last, left £10,750 gross (£10,635 net).

More Exports to the Middle East Needed

THE opportunities that the Middle East offers as a large and expanding market are not being fully exploited by British companies, Mr. F. J. Erroll, Minister of State, Board of Trade, said in London on Monday. Mr. Erroll was introducing a booklet, "Exporting to the Middle East," which has been produced by the Advisory Council on Middle East Trade (A.C.M.E.T.). This booklet, which has been widely circulated to manufacturers and to trade associations, and is available from the Board of Trade free of charge, emphasises the importance of these markets, states frankly the difficulties which exist and suggests how some of them can be met.

It points out that the exports of twelve principal manufacturing countries to the Middle East were some three times greater in volume in 1958 than they had been in 1938. The main reason for this increase was the rise in oil revenues now approaching £500 million a year. Britain's share of the area's imports had, however, fallen from 40·4 per cent in 1948 to 24 per cent in 1958. This was due to intense competition from other countries, especially Germany and Japan, and the greater activity, backed by credit agreements, of the Soviet bloc.

But the booklet makes it clear that Britain is in a strong position to compete. Our goods are competitive in quality, deliveries, styling and credit terms. We are large buyers of oil, English is widely spoken, and British business methods highly regarded. The present demand is for capital goods and cheap and simple consumer goods, but there are signs of a growing demand for better quality. Persia is currently the best market, but the best prospects for an increase in trade are probably in the oil states of the Persian Gulf.

Mr. H. G. Nelson, managing director of the English Electric Co., Ltd., and vice-chairman and industrial leader of the Council, said that too much emphasis could be put on the political instability of the area. They must look ahead to the opportunities. Governments might change but they were all out to raise the standard of living as fast as possible. One of the great advantages of the Middle East as a market was its ability to pay for its requirements. He urged his fellow industrialists to make more frequent visits to the Middle East. Continuing personal contact was the best way of exploiting the goodwill that existed towards this country and its products.

Apprentice Training Schemes

With the autumn issue of its journal, *Electrical Machinery*, the Association of Electrical Machinery Trades has issued a supplement showing the opportunities which are open in its member firms for craft apprentices in the repair, rewinding, maintenance and installation of all types of power plant.

Diamond Jubilee of I.E.E. Centres

THE North Eastern Centre of the Institution of Electrical Engineers was formed on 14th December, 1899, and it shares with the Scottish Centre (which had the same date of formation) the honour of being the oldest of the local centres of the Institution. Mr. J. R. Beard has been invited to deliver a jubilee address at a meeting of the Centre on 14th December.

It has been agreed that both the North Eastern and Scottish Centres should co-operate in a tangible and permanent recognition of this occasion subscribed for by members of each Centre. The fact that the rebuilding work at the Institution includes the complete reconstruction of the lecture theatre provides an opportunity to present two carved attendance register desks. The motif of the carving on each desk will be slightly different so that one will be identified with the North Eastern Centre and the other with the Scottish Centre. It is anticipated that the response from the two Centres will be such that, in addition to the two desks, there will also be sufficient money available to provide one or possibly two presidential chairs for the lecture theatre and council room. It is hoped that the desk contributed by the North Eastern Centre will be presented during the President's visit to the Centre on 14th December.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £264 0s 0d
Fire Refined 99·70%	ton £263 0s 0d
Fire Refined 99·50%	ton £262 0s 0d
COPPER Tubes ..	lb 2s 6½d
Sheet	ton £297 5s 0d
H.C. wire and strip..	ton £311 5s 0d
LEAD, English ..	ton £73 5s 0d
Foreign	ton £72 0s 0d
MERCURY	flask £72 0s 0d
TIN, block (English) ..	ton £794 10s 0d
ZINC, G.O.B. Foreign	ton £95 15s 0d
BRASS Tubes (solid drawn)	lb 2s 1⅛d
Wire	lb 2s 10½d
PHOSPHOR BRONZE Wire	lb 4s 4⅜d
PLATINUM ..	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 35½d (nom.)

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets have continued this month to witness a good deal more irregularity in the movement of prices than was the case during October's almost unchecked advance. At times the selling to consolidate profits, and the feeling that enthusiasm had been overdone, have gained sufficient ascendancy to bring quotations back fairly sharply. So far, however, the buyers have always been there in sufficient strength to produce effective rallies: many members have indeed expressed themselves as impressed by the weight of money which still seems to be held in reserve for use at any opportunity to pick up stock on any sizeable setback in prices.

Market Reaction

Some of the losses shown by industrial share prices during the recent reaction were fairly substantial by normal standards, but very few looked at all significant in comparison with the extent of the previous month's advances. Among the leaders in the electrical markets, A.E.I., at 63s 9d, were showing a setback of half-a-crown at the beginning of this week, while G.E.C. at 42s 6d and English Electric at 46s 3d were down by 1s 6d and 1s 9d respectively. Crompton Parkinson, at 18s, shed 1s of the previous week's advance on the increase in the dividend. Cable manufacturing and heavy engineering shares remained dull, with B.I.C.C. 1s 3d lower at 53s 3d, and Babcock & Wilcox a further 2s 3d down at 44s.

Mixed Changes

Reactionary tendencies have been apparent also in the popular groups of domestic equipment investments, among which Hoover at 95s lost 3s 9d of the previous much more substantial gains. Motor accessory issues, another group in high favour recently, retraced some of their earlier rises, Chloride Electrical coming back 3s 9d to 68s 3d, and Lucas 3s to 67s in advance of the final dividend declaration. Elsewhere Thorn Electrical shed 3s 3d to 45s 6d, while Plessey at 42s 6d, Decca "A" at 41s 9d, and Ever Ready at 25s 6d, all lost some ground. On the other tack, Ericsson Telephones were notably well supported up to 27s 6d (a gain of 3s 6d on the week) and there were good improvements elsewhere in E.M.I. at 65s, Telegraph Condenser at 57s 6d and British Vacuum Cleaner at 10s 3d. Crabtree Electrical retained the previous week's advance of more than 10s to 46s 3d on the strength of the excellent results shown in the company's annual report for the year ended 31st July last.

S. Smith & Sons Results

Results announced by S. Smith & Sons (England) for the twelve months ended on 1st August were well up to the expectations on which this year's big rise in the price of the 4s shares has been based. They were not greatly altered, at around 20s 9d, after the news. Whereas the directors, in last year's report, had been budgeting for earnings at about the same level as

Price Changes in

Company or Board	Nom. Value	Middle price 9th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	80½		3	3	3 14 6	80½	77½
Brit. Elec. 1974/77	100	77½		3	3	3 17 6	77½	74½
Brit. Elec. 1976/79	100	80½	−½	3½	3½	4 7 0	81	77½
Brit. Elec. 1974/79	100	91½		4½	4½	4 12 9	91½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/6		6·8†	7†	11 15 0	19/6	16/-
East African Power	£1	22/6	+2/6	7½	8	7 2 3	22/6	19/3
Nigerian Elec.	£1	17/6	+1/-	8	8	9 2 9	17/6	13/-
Perak Hydro-Elec.	£1	15/-		12½	10	13 6 9	15/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	17/9	−1/-	17½	17½	5 1 6	18/9	15/6
Aerialite	1/-	9/6	−2/6	54	54	5 12 6	12/3	7/9
Allen, W. H.	£1	53/9	+6d	11	12	4 9 3	53/9	43/-
Allied Insulators	5/-	23/6		—	20‡	4 5 0	23/6	18/9
Anglo-Portuguese Tel.	£1	30/9	+9d	9	9	5 17 0	30/9	26/6
Aron Elec. Ord.	£1	50/-		15	15	6 0 0	62/6	50/-
Assoc. Elec. Ord.	£1	63/9	−2/6	15	15	4 14 0	67/-	53/9
Automatic Tel. & El.	£1	80/-		17	17‡	4 5 0	82/6	71/3
Babcock & Wilcox	£1	44/-	−2/3	13½	13	5 18 3	52/6	43/9
Bakelite	10/-	38/-	−2/-	15	15	3 19 0	40/-	22/-
Baldwin, H. J.	2/-	2/6	+3d	20	—	—	3/-	2/-
Berry's Electric	5/-	29/3	+6d	10	20‡	3 8 6	29/9	7/3
Bowthorpe Holdings	2/-	10/9		25	27	3 0 6*	10/9	8/-
British Elec. Traction: Def. Ord. "A"	5/-	46/-	−1/6	25	35	3 16 0	47/6	35/6
B.I. Callender's	£1	53/3	−1/3	12½	13½	5 1 6	58/6	44/9
B.I. Callender's 6% Pref.	£1	21/-		6	6	5 14 3	21/-	19/9
British Thermostat	5/-	23/-	−9d	30	35	3 16 0*	28/-	18/6
British Vac. Cleaner	5/-	10/3	+9d	10	7½*	3 13 3	10/3	4/6
Brook Motors	10/-	59/6		25	24½*	4 1 0	59/6	46/-
Bulgin, A. F.	1/-	11/6		45	50	4 7 0	11/6	6/9
Bulpitts	5/-	18/6	−3d	—	15	4 1 0	18/9	10/-
Burco Dean	5/-	18/-	−3d	22½	16*	4 9 0	18/3	12/3
Cable & Wireless: Ord.	5/-	18/-	−3d	10	10*	2 15 6	18/3	12/3
4% Loan	100	96	+1½	4	4	4 3 3	96	93
Chloride El. Storage "A"	£1	68/3	−3/9	17½	20‡	3 17 0*	72/-	43/8
Clarke Chapman	£1	57/6		27½	13½*	4 15 9	66/3	52/6
Cole, E. K.	5/-	24/6	−6d	17½	20	4 1 9	25/-	17/3
Contactor Switchgear	5/-	14/-	−6d	14	14	5 0 0	16/9	12/-
Cossor, A. C.	5/-	7/3	−3d	Nil	5	3 9 0	9/-	6/3
Crabtree	10/-	46/3	—	20	20	4 6 6	48/9	28/-
Crompton Parkinson	5/-	18/-	−1/-	12	14	3 17 9	19/-	11/9
Davis & Timmins	5/-	22/-	+2/-	18	20	4 11 0	22/-	14/6
De La Rue	10/-	60/-	−4/-	17½	20	3 6 3	64/-	30/3
Decca "A"	10/-	41/9	−2/6	43½	50	4 15 9*	44/3	33/3
Desoutter	5/-	31/-		32½	23½*	3 10 3	31/-	19/-
Dewhurst	2/-	9/-	+3d	20	20	4 9 0	9/-	7/3
Dictograph Tel.	2/-	9/3		20	20	4 6 6	9/3	7/-
Dubilier Condenser	1/-	5/3	−3d	20	25	4 15 3	5/6	3/3
Duport	5/-	18/9	+9d	25	12½*	3 6 9	18/9	10/3
E.M.I.	10/-	65/-	+2/6	15	20*	3 1 6	64/6	48/-
Electrical Apparatus	5/-	15/-		14½	14½	4 16 9	16/6	13/-
Electrical Components	5/-	12/6		12½	15	4 0 0*	12/6	7/-
Elec. Construction	£1	35/9	−1/3	8½	9	5 0 9	37/-	27/9
Elliott-Automation	5/-	28/9	−3d	—	10‡	1 14 9	30/6	16/9
English Electric	£1	46/3	−1/9	14	14	4 1 0*	48/9	37/10
English Electric 3½% Pref.	£1	13/-		3½	3½	5 15 6	12/9	12/3
Ericsson Tel.	5/-	27/6	+3/6	12†	13†	3 16 9	28/-	22/3
Ever Ready	5/-	25/6	−2/-	20	27½‡	3 4 6*	28/-	13/3
Falk Stadelmann	£1	35/-	+1/3	10	10	5 14 3	35/-	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

in 1957–58, the group profit is now shown to have expanded by nearly 7 per cent, and the net surplus, after tax, by some 19 per cent to £1·9 million. This provides amply for an increase in the ordinary dividend from a total of 12½ to 17½ per cent, which is covered three times by the available surplus, and leaves about £1½ million retained in the business. Added to the figure of more than a million provided for depreciation, the latter goes most of the way towards covering the estimate of the capital expenditure required for the completion of the company's three-year expansion programme. The yield on the shares is now just under 3½ per cent.

Morphy-Richards' Progress

Sales of the Morphy-Richards group expanded by 15 per cent to more than £9 million during the twelve months to last June, and in his review accompanying the full report the chairman tells shareholders that there was a further substantial increase in the first quarter of the current year, in comparison with the same months of 1958. As already known from the preliminary statement, the net taxed profit for 1958–59 was half as large again as the previous year's, and the ordinary dividend is being raised by 5 to 25 per cent. Export business has been difficult, and prices to the consumer are to be kept as low as possible, but in general Mr. F. P. Bishop's review is hopeful that net profits will continue to reflect the growth of sales. At 30s the 4s shares show a yield of just on 3½ per cent from a dividend covered 2½ times by earnings.

Ward & Goldstone

The uninterrupted expansion of Ward & Goldstone's business over the past decade has enabled the company to make some increase each year in the ordinary shareholders' dividend, while adding all the time to the reserves on such a scale as to provide for free scrip issues at frequent intervals. A yield of less than 2¾ per cent from the 5s shares, on the basis of the 30 per cent dividend paid for 1958–59, suggests firm expectations of further benefits on account of the present year. These were given encouragement by the declaration of an increase in the interim dividend from 7½ to 10 per cent, after which the 5s shares were marked up further to 57s 6d. The company hopes that despite lower profit margins the higher sales recorded so far this year will enable profits to be maintained, if not increased.

Company News

Trading results of Pye are said by the directors to be continuing to show material improvement on last year's. They anticipate the maintenance of the present 12½ per cent rate of dividend on capital increased not only by this year's one-for-two "rights" issue but also by the proposed 10 per cent scrip issue. The 5s shares have been fairly steady at around 20s. Aerialite 1s shares, which had been run up to 12s immediately in advance of the dividend declaration, have come back to 9s 6d since the company's announcement of lower earnings and no change in the distribution of 54 per cent. The chairman of Pifco Holdings reported that turnover had in recent months been running a little above last year's level. At 29s 6d, the 4s shares of the company show a yield of 3½ per cent on the well-covered 25 per cent dividend.

Electrical Investments

Company or Board	Nom. Value	Middle price 9th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C.	£1	42/6	−1/6	10	10	4 14 3	48/-	31/3
G.E.C. 6½% Pref.	£1	23/-	+6d	6½	6½	5 13 0	23/-	20/3
General Cables	5/-	8/3	+6d	24	15	9 1 9	9/3	7/6
Greenwood & Batley	£1	115/-	+5/-	20	30	5 4 3	115/-	75/-
Hackbridge Holdings	5/-	16/3	−1/-	20	20	6 3 0	19/3	14/3
Hackbridge & Hewittic	5/-	15/-	−6d	20	20	5 0 0*	15/6	10/6
Head Wrightson	5/-	35/6	−1/3	17½	20*	2 16 3	38/-	24/3
Heatrae	2/-	10/-		20	20	4 0 0	10/-	7/6
Holophane	5/-	20/-		22½	26	6 10 0	20/-	14/9
Hoover	5/-	95/-	−3/9	50	60	3 3 3	98/9	55/-
I.C.I.	£1	54/6	−1/2	12	8*	2 18 9	55/6	33/-
Intl. Combustion	5/-	36/3	−1/3	25	30‡	4 2 9	38/6	29/9
Intl. Computers & T.	£1	72/6		—	8‡	2 4 0	78/9	57/6
Johnson & Phillips	£1	21/-		5	5	4 15 3	30/6	20/-
Lancashire Dynamo	£1	47/6	−1/3	11	12½‡	3 19 0*	48/9	31/6
Laurence Scott	5/-	18/9		15	15	3 9 0*	18/9	14/-
Lister, R. A.	£1	50/-	−6d	10	12½	5 0 0	50/6	32/9
Lucas, J.	£1	67/-	−3/-	7½	10‡	2 19 9	70/-	43/3
Marconi Marine	£1	42/-		10	10	4 15 3	48/6	40/-
Marryat & Scott	2/-	11/3	+3d	37½	22½*	4 0 0	11/-	8/6
Mather & Platt	£1	49/-		15	10‡*	4 6 6	51/6	41/3
Metal Industries	£1	66/3	+1/3	14	14	4 4 6	66/3	39/9
Midland Elec. Mfg.	£1	48/9		12½	10*	4 2 0	48/9	41/6
Morphy-Richards	4/-	30/-		20	25	3 6 9	34/-	18/-
Murex	£1	58/-	−9d	17½	15	5 3 6	58/9	42/-
Newman Ind.	2/-	3/3		10	10	6 3 0	3/6	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/3	2/6
Parsons, C. A.	£1	52/-	−6d	7½	8½‡	3 2 6	58/-	45/9
Philips' Lamps	Fl.10	130/-	+6/-	14	14	2 0 0	130/-	88/-
Plessey	10/-	42/6	−1/-	30	14*‡	3 6 0	44/6	23/6
Pye	5/-	20/-	−3d	12½	12½	3 2 6	20/3	13/9
Pyrotenax	5/-	47/-		—	34	3 12 6	47/-	33/9
Reliance Clifton	5/-	23/-	−6d	15	15	3 5 3	24/6	17/6
Reyrolle	£1	91/-	−6d	17½	17½	3 17 0	98/-	85/9
Rheostatic	4/-	12/-		12½	12½	4 3 3	12/-	8/3
Richardsons Westgarth	10/-	12/3		8½	8½	6 16 0	15/3	11/6
Simon-Carves	5/-	30/9	−6d	25	25	4 1 3	32/-	28/6
Smith (England), S.	4/-	20/9	−3d	12½	17½	3 7 6	21/-	11/6
Southern Areas	£1	15/-	+6d	Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	17/3	−9d	15	20	5 16 0	18/-	8/6
Sturtevant	5/-	23/6		15†	15†	5 5 9	23/6	17/-
Sun Elec.	5/-	16/3		25	25	3 17 0*	16/9	8/3
Switchgear & Cowans	5/-	16/-		22½	15*	4 13 9	16/-	10/3
T.C.C.	10/-	57/6	+2/6	25	25	4 7 0	58/-	38/-
Telephone Mfg.	5/-	7/-		10	10	7 2 9	7/3	4/9
Telephone Rentals	5/-	19/-	+1/6	12½	12½*	3 5 9	19/-	11/9
Thompson (John)	5/-	19/6	−6d	25	25	6 8 3	25/6	20/-
Thorn Elec.	5/-	45/6	−3/3	17½	20	2 4 0	48/9	26/3
Thornycroft	£1	25/-	−9d	7½	6	4 16 0	30/-	20/6
Tube Investments	£1	117/6	+1/3	17½	20	3 8 0	120/-	71/6
Vactric	5/-	43/6	−2/6	25	37½	4 6 3	46/6	26/3
Veritys	5/-	1/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	15/-	−3d	22½	22½	3 8 3*	15/3	10/8
Ward & Goldstone	5/-	57/6	+1/6	25	30	2 12 3	57/6	30/6
Watford	2/-	13/3	−1/3	25	25*	3 15 6	14/9	7/6
Westinghouse	£1	52/6		10	10	3 16 3	53/9	39/6
West, Allen	5/-	14/6	+6d	12½	11‡*	4 0 6	14/6	11/9
Wolf Electric	5/-	9/9		10	10	5 2 6	9/9	7/9

REPORTS and DIVIDENDS

Morphy-Richards, Ltd.—The main figures in the accounts for the year ended 30th June last were given in our issue of 23rd October. In his review of the year, which has been circulated to stockholders, Mr. F. P. Bishop (chairman) says that group sales were just over £9,000,000, an increase of 15 per cent on 1958. The sales of all their products were well maintained throughout the year, but the big improvement in results was due essentially to the increased emphasis on sales of major appliances. Relaxation of the credit restrictions last autumn has greatly stimulated the demand for refrigerators and spin dryers, but even before that they were producing these items to capacity. During the year they obtained possession of a further extension of 60,000 sq ft to the existing factory at Dundee, and they were able to rent another 40,000 sq ft nearby. Still the pressure on demand continues and they hope that the new factory will be in production by 1961. Their other subsidiary companies had varying fortunes. Yelsen, Ltd., now sells the whole of its output of electric blankets to Morphy-Richards, Ltd., and its accounts are virtually merged in those of the parent company.

Of the overseas companies, the subsidiary in the United States did very well and has paid a substantial dividend this year. They have acquired the minority interest in Morphy-Richards (Canada), Ltd., which is now a wholly-owned subsidiary. On the other hand they have disposed of 10 per cent of the equity in the South African company to their South African associates, and this company is doing well. The Australian company made a loss. In Europe they have added another wholly-owned subsidiary to promote their sales in Holland. The associated company in Germany has done well and has paid a dividend.

Referring to plans for changes in the structure of the group, Mr. Bishop says that the board proposes to make Morphy-Richards purely a holding company. This will entail the formation of two new wholly-owned subsidiaries, one to take over the St. Mary Cray operations, and another to provide certain central services to all members of the group; it will be purely an internal reconstruction to promote efficiency.

With regard to the outlook, the general feeling of optimism about the economic outlook is reflected in the order books, and sales in the first quarter of the current financial year, both from St. Mary Cray and from Dundee, again show a substantial increase over those in the same period last year. If there is a darker side to the picture it is in parts of the export field. Export sales were down by over £100,000 last year, though this is more than accounted for by the losses of exports to New Zealand due to Government action there. They have now established manufacturing facilities in New Zealand under a licensing agreement which has begun to earn royalty income.

Power Cable Merger.—Enfield Rolling Mills, Ltd., and Standard Telephones & Cables, Ltd., announce that they have concluded negotiations for the merger of the power cable businesses carried on by Enfield Cables, Ltd. (a wholly-owned subsidiary of Enfield Rolling Mills, Ltd.), and by Standard Telephones & Cables, Ltd., respectively. For that purpose it is proposed that a new company shall be formed which will be owned equally by Enfield Cables and Standard Telephones & Cables. The new company's operations will be restricted to power cables and will start on 1st January next. The proposals are subject to the sanction of the holders of the 4 per cent first debenture stock 1961-76 of Enfield Cables.

Gas Purification & Chemical Co., Ltd.—The trading profit for the year ended 30th June last amounts to £505,336, as compared with a deficit of £135,340, and after meeting all charges, including £212,874 for taxation, the net balance is £292,462 (against a loss of £216,343). After adding £10,132 provision for taxation no longer required, the deficit brought in is reduced from £469,392 to £172,516.

Reviewing the activities of the companies in the group, Vice-Admiral Sir Charles H. Hallett (chairman) says that A.B. Metal Products, Ltd., made a larger profit and it had a larger outstanding order book than at any time in its history. Wolsey Electronics, Ltd., shows a considerably increased turnover and it has made a substantial profit. The outlook of Johnson British Electric, Ltd., is extremely healthy, with orders being planned on a fairly long-term basis. The electrical division of Smart & Brown (Machine Tools), Ltd., has been suffering from difficulties largely arising from a change in Government policy of a year or two ago, but the current position is now encouraging. The results of B. & R. Relays, Ltd., are gratifying and the company is now earning satisfactory profits.

Assuming that the present trading of the group continues, there is no doubt that it will be possible to return to the dividend list in respect of profits for the year ending 30th June next year.

S. Smith & Sons (England), Ltd., report a group trading profit for the year to 1st August last of £3,603,977, as compared with £3,382,306 for the preceding year. Taxation absorbs £1,673,357 and, after deducting minority interests of £22,890, the net balance attributable to the parent company is £1,907,730 (against £1,603,101). It is proposed to pay a final dividend of 13 per cent, making 17½ per cent for the year (against 12½ per cent).

Tricity Finance Corporation, Ltd.—A controlling interest in this company (the hire-purchase subsidiary of Thorn Electrical Industries, Ltd.) has been acquired by Lombard Banking, Ltd. The purchase consideration for Lombard's 51 per cent is £663,000 and is wholly payable in cash. At the date of acquisition hire-purchase debtors exceeded £4,000,000. Authorised and issued capital of Tricity Finance is being increased to £1,000,000.

Tricity Finance Corporation, in becoming a subsidiary of the Lombard Banking Group, will further extend Lombard's activities in the consumer-domestic hire-purchase and credit finance field throughout the United Kingdom. An immediate result of the link-up will be the availability of substantial hire-purchase and credit-finance facilities to retailers and users of all products manufactured by the Thorn Group, including Ferguson, Philco, and (under licence) H.M.V. and Marconiphone radio and television receivers. Retailers of Thorn products will also have the services of over sixty Lombank branches throughout the country. The board of Tricity Finance Corporation will comprise three members of the Thorn Group, Messrs. R. E. Davis (chairman), A. Deutsch and G. J. Strowger, and three members of the Lombard Banking Group, Messrs. D. E. C. Hawkins (deputy chairman), G. C. E. Sabine and J. M. Pickard. The policy and general management of the company will remain unchanged.

Oliver Pell Control, Ltd., reports that after providing £7,468 for taxation the net profit for the year to 31st March last is £13,218, as compared with £18,930 for the preceding year. The dividend for the year is maintained at 6 per cent and £109,392 is carried forward (against £100,162 brought in).

Aerialite, Ltd.—The accounts for the year ended 31st May last show a profit, before taxation, of £295,824, as compared with £396,125 for 1957-58, and after deducting taxation, the net balance is £172,439 (against £181,116). It is proposed to pay a final dividend of 34 per cent, again making 54 per cent for the year.

Simon-Carves, Ltd., has declared an interim dividend of 10 per cent (unchanged).

Bakelite, Ltd., is paying an interim dividend of 6 per cent (against 5 per cent).

The Heenan Group, Ltd., reports group trading profits for the year to 29th August last of £521,469, as compared with £419,481 for the previous year, and a net profit of £258,880 (against £169,314). It is proposed to pay a final dividend of 12½ per cent,

making 15 per cent (against 10 per cent) for the year.

G. & J. Weir Holdings, Ltd., are paying an interim dividend of 6 per cent (against 4 per cent). It is stated that the increase does not indicate a higher total.

Pye (Ireland), Ltd., has declared an interim dividend of 2 per cent (unchanged).

Ward & Goldstone, Ltd., are paying an interim dividend of 10 per cent (against 7½ per cent).

Rediffusion, Ltd., has announced an interim dividend of 7½ per cent tax free (against 6 per cent) on capital increased last March by a "rights" issue.

The East African Power & Lighting Co., Ltd., has announced an interim dividend of 3 per cent (unchanged) on increased capital.

New Companies

Reynolds (Electrical), Ltd.—Registered 8th October. Capital £3,000. Radio, television, electrical and general engineers, etc. S. E. Reynolds is permanent managing director. Regd. office: 154, Bath Street, Ilkeston.

Lamb & Hawthorn, Ltd.—Registered 13th October. Capital £100. Electricians, electric wiring contractors, electrical engineers, etc. Directors: D. R. Lamb, S. K. Hawthorn and E. Symons. Regd. office: 2, Endsleigh Street, W.C.1.

Delmatic, Ltd.—Registered 12th October. Capital £100. Electricians, electrical engineers, etc. Directors: J. Woodnutt and Mrs. Moira Woodnutt. Regd. office: Linden, Hillbrow Road, Esher, Surrey.

M. J. Fairman, Ltd.—Registered 8th October. Capital £100. Electricians, electrical contractors, electrical engineers, etc. Directors: M. J. Fairman and Mrs. Vivienne Fairman. Regd. office: 286, High Street, Rochester, Kent.

Alfred H. Hunt (Watford), Ltd.—Registered 9th October. Capital £100. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: A. H. Hunt and Margaret M. Hunt. Regd. office: 141, Bushey Mill Crescent, Watford.

Sweeting-White (Domestic), Ltd.—Registered 13th October. Capital £5,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: W. F. G. Sweeting-White and R. J. Sweeting-White. Regd. office: 6, Gate Street, W.C.2.

Art Electric (Manufacturing), Ltd.—Registered 26th October. Capital £100. Manufacturers of electric fittings, etc. Regd. office: Chancery House, Chancery Lane, W.C.2.

Hill's Enterprises, Ltd.—Registered 26th October. Capital £1,000. Manufacturers of and dealers in electrical plant, machinery, appliances and supplies, etc. Directors: B. Hill (permanent) and Edith M. Hill. Regd. office: 365, Foleshill Road, Coventry.

Drayton Controls (Heating), Ltd.—Registered 15th September. Capital £100. Manufacturers of and dealers in equipment, apparatus and plant connected with space heating, air conditioning and water supply, including instruments, controllers and steam traps, etc. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

Planet Electrical, Ltd.—Registered 19th October. Capital £3,000. Manufacturers of and dealers in machines, plant, tools, etc. Directors: T. E. Tildesley and Miss Lillian K. Batten. Regd. office: Steward Street, Birmingham, 18.

Cassor Electric Motors, Ltd.—Registered 22nd October. Capital £5,000. Manufacturers of and dealers in electric motor transformers and voltage regulating equipments, chokes, coils, switchgear, etc. Directors: C. Collins, F. A. Grein, E. Leggett and J. S. Lee. Regd. office: 74, Portsmouth Road, Surbiton, Surrey.

Moorside Appliances, Ltd.—Registered 15th October. Capital £3,500. Manufacturers of and dealers in vacuum cleaners, washing machines and electrical goods of all kinds, etc. Directors: R. Garnett and A. Hall. Regd. office: 90, Town Street, Armley, Leeds.

Wood & Metcalfe, Ltd.—Registered 20th October. Capital £300. Electricians, electrical engineers, etc. Solicitors: Ashton Hill & Co., 32, Heathcoat Street, Nottingham.

S. T. Saunders & Sons, Ltd.—Registered 15th October. Capital £300. Manufacturers of and dealers in electrical equipment and accessories, etc. Directors: S. T. Saunders, C. B. Saunders, Hilda D. Saunders and R. A. Saunders. Regd. office: 125, College Hill Road, Harrow Weald, Middlesex.

Bankruptcies

A. Roberts, lately carrying on business as an electrical and hardware dealer under the style of Roberts Radio and Television Services, at 18, Penygraig Road, Penygraig, Glam., and at Hill View Stores, Tonyrefail, Glam.—Receiving order made 26th October on debtor's own petition. Public examination 12th January at the Court House, Courthouse Street, Pontypridd, Glam.

C. A. Norwood, foreman electrician, formerly an electrical contractor, carrying on business at 38, Thornbury Road, London, S.W.2.—Application for discharge to be heard on 11th December at the Court House, Garratt Lane, Wandsworth, London, S.W.18.

E. Vasey, 21, Bridge Road, Bishopthorpe, York, electrician.—Supplemental dividend of 3s 2½d in the £, payable at the Official Receiver's Office, Pearl Chambers, East Parade, Leeds, 1.

M. S. Pollard, lately carrying on business as a builder and electrical engineer at 21, Preston Road, Brighton, and at the rear of 5, Southview Road, Southwick.—Trustee, Mr. R. A. J. Croydon, 7, Old Steine, Brighton, appointed 27th October.

R. J. Phipps and **W. L. Brooks,** formerly carrying on business in partnership at 4, King Street, Tamworth, Staffs., under the style of Phipps Brothers, electrical contractors.—Trustee, Mr. W. H. Haigh, Somerset House, 37, Temple Street, Birmingham, 3, Official Receiver, released 27th October.

A. Banoff (trading as Almyn Radio Electric Co.), lately carrying on business at 111, Church Road, Hove, electrical and radio engineer.—Trustee, Mr. H. C. Hedges, 4, Charterhouse Square, London, E.C.1, released 1st October.

J. E. Bowman, 21, Leazes Park Road, Newcastle-upon-Tyne, trading as Bowman Bros., electrical engineer and contractor.—First and final dividend of 2s 0¾d in the £, payable at the Official Receiver's Office, Clarendon House, Clayton Street West, Newcastle-upon-Tyne, 1.

Liquidations

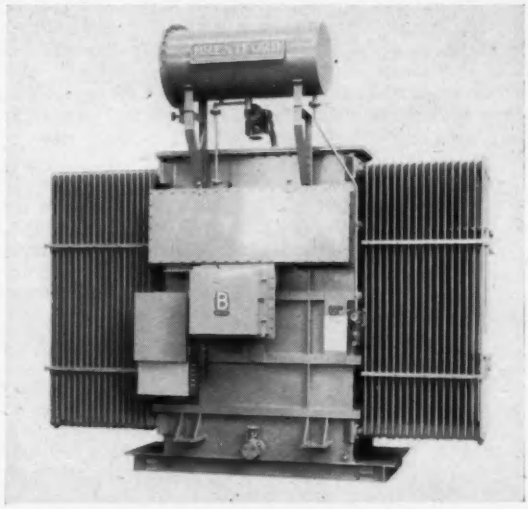
A. W. Barker & Co., Ltd., dealers in electrical machinery, 4, Bath Road West, Slough, Bucks.—Winding up voluntarily. Liquidator, Mr. C. J. Fahy, 4, Bath Road West, Slough, appointed 27th October. Particulars of claims to the liquidator by 30th November. This notice is purely formal. All creditors have been or will be paid in full.

Fitted Interiors (Contracts), Ltd., electrical appliance company, 23, George Street, London, W.1.—Winding up voluntarily. Liquidator, Mr. M. Goldstein, 220-226, Bishopsgate, London, E.C.2, appointed 9th October.

Frederb, Ltd., electrical goods retailers, 42, Attercliffe Common, Sheffield, 9.—Winding up. Liquidator, Mr. P. Cardwell, 93, Queen Street, Sheffield, 1, appointed 28th October. Particulars of claims to the liquidator by 31st December.

Large Rectifier Installation

IN a recent issue we described the 2·6 MW silicon rectifier installation which is being supplied by Standard Telephones & Cables, Ltd., to the Electrolytic Metals Corporation in the South African Transvaal for the electrolytic production of manganese. Basically this plant consists of four rectifier cubicles each rated at 650 kW at 5,000 A. In order to provide the necessary voltage regulation a single 3·5 MVA stepless on-load voltage regulator supplied by Brentford Transformers, Ltd., controls the input voltage to the rectifier transformers. Stepless variation of this voltage from 3,700 to 8,600 V is provided using six booster transformers which are automatically switched in or out of circuit by means of a motor-driven selector switch, the regulator being connected to each booster in sequence. The plant supplied by Brentford Transformers, Ltd., consists of four rectifier transformers and the voltage regulating unit, embracing the regulators, six booster transformers, one step down transformer and the selector switch interstage unit.



Brentford Transformers 3·5 MVA stepless on-load voltage regulator

New Books

Microwave Data Tables. By A. E. Booth. Pp. 61. Published for *Wireless World* by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 27s 6d.

This book is a collection of tables primarily intended for use by engineers and scientists engaged in research and development work involving waveguides and similar transmission lines. In this type of work certain basic relationships occur frequently, and considerable effort is expended in evaluating these relationships to the required degree of accuracy. Among the subjects encountered in these recurring relationships and covered in the tables are frequency, guide and free-space wavelength, standing-wave ratio, voltage and power reflection coefficient, and the decibel.

The author is development engineer in a microwave laboratory and for this reason the book has perhaps a pronounced " waveguide bias "—hence it is of most value to waveguide engineers, but it will also be found useful by engineers concerned with high-frequency transmission lines of the coaxial and similar types, and it should appeal to all engaged in electronics and communications for its decibel tables alone.

It contains 26 tables and over 23,000 computed calculations. All the independent variables are measurable quantities and are given to the limit of measuring accuracy, while the dependent variables are given to one more figure than would be required for most practical purposes, and hence impose no accuracy limitations on practical design and development work. Guide wavelength tables are given for nine sizes of rectangular waveguides and two sizes of circular waveguides—the choice of sizes being directly influenced by current usage. The mathematical basis of all formulæ used in the computations is stated, and comprehensive notes on the use of the tables are incorporated.—T.R.W.

Ferrites. By J. Smit and H. P. J. Wijn. Pp. 369; figs. Philips' Technical Library. United Kingdom distributors, Cleaver-Hume Press, Ltd., 31, Wright's Lane, London, W.8. Price 72s.

Although the term " ferrite " in its modern connotation was first applied to magnetic oxides with a spinel structure, it is taken in this book to refer to all strongly magnetic oxides (both ferro- and ferri-magnetic) with iron as their main metallic constituent. Ferrites have found wide application, and considerable effort has been directed towards understanding the physical phenomena underlying their behaviour. Both Dr. Smit and Dr. Wijn have made important contributions themselves and the book has been written with the authority which accompanies complete familiarity with the subject.

To appreciate the contents of the volume, it is important to note its sub-title, " Physical Properties of Ferri-magnetic Oxides in Relation to their Technical Applications." The authors disclaim any attempt at a complete treatment of the subject and stress that their aim has been to produce an account " on an intermediate level."

The book is divided into four parts. In the first there is a general outline of the theory of ferro- and ferri-magnetism and of magnetisation processes, while the second is devoted to methods of measuring magnetic properties. Thus, the first 135 pages form a general introduction to the subject and may be read closely or rapidly according to the reader's previous experience. The third part deals with the intrinsic properties of ferrites, with special reference to saturation magnetisation and anisotropy, and includes a most instructive chapter on the materials with hexagonal structure; little attention is paid to the garnet-structure materials. The final section discusses the structure and properties of polycrystalline ferrites, their electrical properties, initial permeability and its frequency dependence, and hysteresis loops.

Clearly in so large a field there must be omissions, but they are omissions which one reader will regret yet another will never notice. The book contains a considerable amount of information and has a good bibliography, so that there can be no doubt of its value. It is a pleasure to record that the clear division of subject matter makes the book very easy to use.—K.J.S.

Analogue Electronic Multiplier

A PAPER by Mr. P. Gleghorn entitled " An Analogue Electronic Multiplier Using Transistors as Square-Wave Modulators " was read before the Measurement and Control Section of the Institution of Electrical Engineers last Tuesday. The need for a relatively high-speed analogue multiplier was discussed and the types of multiplier likely to meet this need at reasonable cost were investigated. It was concluded that the modulated square-wave type of multiplier using transistor modulators would be most suitable.

The extension of the scope of the multiplier to operate with inputs of either sign was discussed. The causes of the various errors in the multiplier were examined and an overall accuracy of within ± 2 per cent was quoted. An explanation of the method used to ensure a good frequency response was given, and the transfer function of various parts of the circuit analysed. The experimental results were quoted as being similar in amplitude to a transfer of $1(1+5\times10^{-4}j\omega)$, although the phase shift was considerably better than this.

A number of circuits used to protect the transistors against damaging conditions were discussed. Special attention was given to a separate transistor circuit which disconnects all the power supplies in the event of an irregularity in any one of them.

Guide to Export Finance

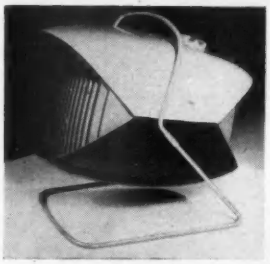
A BOOKLET just published by the British Electrical and Allied Manufacturers' Association, "A Guide to Development and Export Financing Bodies " (price 3s 6d), gives concise information on over sixty organisations, operating or proposed, in countries throughout the world which provide export credit or insurance. The information, which was originally compiled by the Intelligence Department of the English Electric Co., Ltd., for internal use, will be kept up to date by the issue of revised editions.

The provision of capital for economic development and the insuring of export credits is an increasingly complicated aspect of export business. The introduction to the Guide points out that the world's ability to produce goods and materials is beginning to outrun the international financial system, and the currency reserves backing international trade have become inadequate. To meet this situation there has been a rapid increase in development bodies, each one hoping to mobilise capital that is universally scarce. The Guide also mentions that the attempts to make the short-term and medium-term credit systems of international trade supply a larger part of the world's capital requirements has led to the growth of export credit guarantee schemes.

NEW ELECTRICAL EQUIPMENT

Fan Heater

The difficulty of preventing heated air from rising directly to ceiling height instead of remaining at floor level where it is most required, is claimed to have been overcome by TRUVOX, LTD., Neasden Lane, London, N.W.10, with the introduction of their new "Novalux" fan heater. Because of its aero-dynamic styling, either cool or hot air is directed in a broad flat beam and, as the volume of air circulated is of primary importance, the rear of the appliance is open, providing maximum air intake. A single dial controls both the two-stage heating and two-stage cooling. The total loading of the heater is 2 kW and it weighs 6½ lb. It is finished in ivory and coral, with gilt louvres and, as an added safety precaution, a gilt mesh is fitted behind the louvres. The tubular stand on which the heater is mounted is adjustable. The price is £9 16s, including purchase tax.



Truvox "Novalux" fan heater

Wickman spark erosion machine

Changeover Relays

The first of a series of relays, the type D.02 d.c. operated unit and its a.c. counterpart, the type D.52, have been introduced by B. & R. RELAYS, LTD., Temple Fields, Harlow, Essex. The relays measure 1⅜in by 1⅜in by 1⅞in and weigh 3 oz. They are fitted with three changeover contacts, with a choice of contact materials depending upon the duty, the ratings being 10 A at 30 V d.c. and 5 A at 240 V a.c. The average operate and release time is approximately 10 millisec. These units can be supplied with a tropical finish to meet the Ministry of Defence Specification D.E.F. 5000 if desired.

Spark Erosion Machine

A spark erosion machine recently announced by WICKMAN, LTD., P.O. Box No. 44, Banner Lane, Tile Hill, Coventry, has been designed for the semi-automatic production and servicing of dies up to 28in by 16in by 16in deep. The equipment comprises three units, the machine tool, the generator and a dielectric fluid circulator.

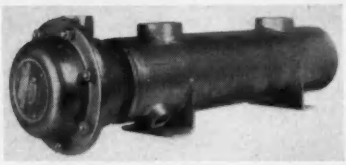
The main body incorporates a work tank having a 32in by 20in table, above which is mounted the servo head having a 28in transverse and a 16in longitudinal travel. Fine adjustment of the servo head is provided on both co-ordinates in increments of 0·001in. The head is in the form of a self-contained cartridge element which can be manually adjusted over 6in vertically to accept different workpiece thicknesses. It is also provided with a 3in automatic quill-stroke driven by a servo-controlled electric motor and is capable of operating an electrode tool weighing up to 20 lb. An adjustable trip switch is provided to stop the cutting operation at an accurate pre-set end-point.

Each of the two alternative generators which can be supplied operates with three cutting ranges. The 13 kW generator has metal removal rates of 1,000 and 3,000 cu mm/min at a controlled frequency of 600 c/s and 100 cu mm/min at random frequency, while the 45 kW generator has a removal rate of 400 cu mm/min at a controlled 100 c/s frequency and 150 and 100 cu mm/min at random frequency.

Hot Water Circulator

The latest addition to the range of central heating equipment manufactured by SANTON, LTD., Somerton Works, Newport, Mon., is the model "QX" central heating hot water circulator. A completely automatic electric central heating boiler, it can be used as the sole means of meeting full central heating and/or domestic hot water needs, as well as operating in conjunction with an existing boiler.

As the "QX" boiler requires no flue it can be fitted in any convenient place in the home. It is available with loadings from 3 to 12 kW and in sizes ranging from 22 to 40in in length. The height of all models is 7in and the width 6in.



Santon model "QX" hot water circulator

A further use for the "QX" heater as a greenhouse heater may be appreciated by horticulturists and nurserymen.

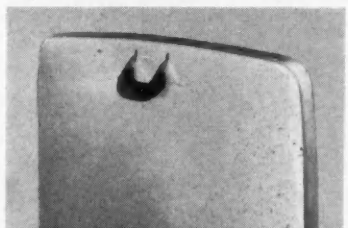
Clothes Dryer

The new "Victor de Luxe" clothes drying cabinet just introduced by the VICTOR MANUFACTURING CO. (GREENGATES), LTD., New Line Works, Greengates, Bradford, supersedes the company's previous models, all of which have now been discontinued. It is provided with a hinged working top for easy handling and use, and, inside, five plastic covered rods are fitted, equivalent to over 8ft of hanging space. Variable heat control for all materials is obtainable, the maximum loading of the black heat elements being 1,500 W. An indicator light is fitted, as well as a thermal cut-out. The cabinet is finished in cream or white and is fitted with castors for easy movement. The price is £13 5s 3d plus £2 9s 9d purchase tax in the United Kingdom.

Convector Heater

The latest convector heater manufactured by HURSEAL, LTD., 229, Regent Street, London, W.1, is a 1·2 kW "Baby" model, the HEC3. It is provided with a two-heat switch, to operate at full load or 600 W, and is available in the 230/250 V range. It is 24in long by 22in high and 3½in

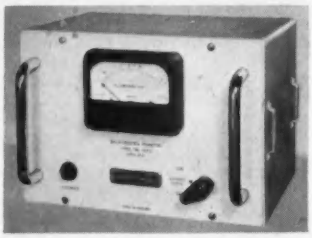
Hurseal model HEC3 1·2 kW heater



deep and weighs only 12 lb. A neat fold-away handle enables the heater to be easily transported. The finish is in pale cream or grey stoved enamel, while the top grille and sides are of anodised metal. It is provided with 6ft of 3-core flexible cable and the price is £8 19s 11d, including purchase tax in the United Kingdom.

Portable Radiation Monitor

A lightweight portable monitor has been developed by PLESSEY NUCLEONICS, LTD., Weedon Road, Northampton, for the measurement of



Plessey portable radiation monitor

background radiation. Detection is accomplished in the Type PNI 1072 instrument by a built-in halogen-quenched Geiger-Muller tube with measurement on a transistor rate-meter giving direct reading of dose rate on a 2½in scale moving coil meter. The instrument has a range of from 0 to 3 milliroentgens per hour on a two decade quasi-logarithmic scale, with a minimum scale calibration of 30 microroentgens per hour. The unit is provided with a 9 V dry battery and weighs only 8 lb.

Clutch Motor Control

Production processes in which "Mardrive" clutch motors are used can now be made automatic or semi-automatic by the addition of two controls which have been developed by the MARINE ENGINEERING CO. (STOCKPORT), LTD., Bulkeley Street, Stockport. For automatic control, the clutch engaging with the face of the flywheel fixed to the rotor shaft and running continuously can be controlled by a solenoid or pneumatic cylinder.

"Mardrive" semi-automatic clutch motor control

When the clutch is released the brake operates immediately. Semi-automatic control for coil winding and similar machines where a gradual acceleration of the driven machine is required is effected by engaging the clutch manually. When the desired speed of the driven machine is reached, it is maintained by a spring-operated latch connected to a solenoid. When the solenoid is energised the latch is tripped, the clutch released and the brake applied. A revolution counter incorporating a pre-set electrical trip can be used with coil winding and similar machines.

Silicon Resistors

A range of silicon resistors, known as "Silistors," having a positive resistance/temperature coefficient of 0·77 per cent per °C at 25°C and an incremental dissipation constant measured in air in a 1 cu ft black box of 11 mW per °C has been announced by STANDARD TELEPHONES & CABLES, LTD., Transistor Division, Footscray, Kent. Resistors from 10 to 470 Ω are available in standard logarithmic series to 20 per cent tolerance.

The units, which have dimensions of 0·7in long by 0·25in diameter maximum with 1½in long leads minimum, are suitable for operation in temperatures between −60 and +150°C and have a maximum dissipation up to 35°C of 1·5 W. A ¼ W "Silistor" having a dissipation constant of 2·3 mW per °C is being developed.

Line Cord Switch

An addition to the range of electrical wiring components manufactured by NETTLE ACCESSORIES, LTD., Warren Street, Stockport, Cheshire, is the 5 A, 250 V, single-pole, on/off line cord switch formerly manufactured by

Nettle line cord switch

A.B. Metal Products, Ltd. Available with black or ivory finish, it is totally enclosed in a moulded case. Cord grips are provided which will take cables up to ⅜in overall diameter. The list price is 4s 3d in black and 4s 6d in ivory.

Hopper Level Switch

Electrical contacts in the hopper level switch introduced by LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20, operate when any free-flowing granular or powdered bulk materials press against the diaphragm. The switch, which is made in "standard" and "sensitive" versions, is housed in a machined brass casting. The diaphragm is backed by a metal plate enabling considerable force to be applied without

Londex hopper level switch

causing damage, and a mounting gasket is supplied to ensure complete dust-proofness.

Single pole changeover snap action contacts are incorporated wired to a three-way terminal block and giving normally open, normally closed or changeover positions. Switching capacity is up to 3 A 440 V a.c. and 5 A 250 V a.c. Contact ratings for d.c. are dependent upon the application.

Cable Connector

A recent addition to the range of "Briticent" products manufactured by

"Briticent" 5 A connector

the BRITISH CENTRAL ELECTRICAL CO., LTD., Briticent House, 6 & 8, Rosebery Avenue, London, E.C.1, is a 5 A flexible cable connector. The two halves of the connector, which have external mouldings in "Alkathene" and interiors moulded in rubber, interlock when pushed together so that the connector cannot accidentally be separated. The standard entry is for flat twin flexible and the list price is 3s per pair.

Cable Eccentricity Monitor

The scope of the cable eccentricity monitors manufactured by the ADDISON ELECTRIC CO., LTD., 10-12, Bosworth Road, London, W.10, and used for determining the eccentricity of conductors or sheaths within the dielectric during the extrusion of wires and cables, has recently been extended. The range comprises individual indicator units for horizontal and vertical eccentricity, a cathode-ray display unit for pictorially presenting the cable cross-section, strip chart recording units, warning units and control units for automatic eccentricity correction. A new push-button selector switch allows the monitoring of any one of up to four gaugeheads mounted in different extrusion lines from the one main instrument. This mode of operation is more convenient and economical than the use of a single portable gaugehead.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1947

16824. Ginns, D. W.—Nuclear reactors. 8th April, 1948. (823364.)

1954

20003. Specto, Ltd.—Electric synchronising apparatus. 10th October, 1955. (Cognate application 188, 4th January, 1955.) (823365.)

35461. Painton & Co., Ltd.—Manufacture of waveguide attenuators. 7th December, 1955. (823367.)

37171. Philips Electrical Industries, Ltd.—Position selecting, scanning and like systems. 6th December, 1955. (823201.)

1955

2431. Electric & Musical Industries, Ltd.—Tunable circuits for high frequencies. 12th January, 1956. (823205.) 3176. Sawtooth waveform generators. 26th January, 1956. (823370.)

3982. Hunt (Capacitors), Ltd., A. H.—Electrical capacitors for use with printed circuits. 10th February, 1956. (823371.)

6444. English Electric Co., Ltd.—Vibration isolators. 5th March, 1956. (822805.)

14982. Siemens & General Electric Railway Signal Co., Ltd., Hilbourne, R. A., and Jones, D. D.—Railway signalling systems. 23rd May, 1956. (823149.)

18182. International Computers & Tabulators, Ltd.—Electronic calculating apparatus. 22nd June, 1956. (823374.)

18919. Rank Cintel, Ltd.—Cathode-ray counter tubes. 2nd July, 1956. (823528.)

21898. General Electric Co., Ltd.—Electrical devices including encased ferromagnetic cores, and methods of manufacturing thereof. 24th August, 1956. (823376.)

28290. Bird Electronic Corporation.—Coaxial line load device. 4th October, 1955. (823028.)

28588. Staar, M. J. H.—Electric motors. 7th October, 1955. (823042.)

28925. Philips Electrical Industries, Ltd.—Electric welding circuit arrangements. 11th October, 1955. (823212.)

30469. Philips Electrical Industries, Ltd.—Apparatus for gas analysis. 25th October, 1955. (823051.)

31462/3. Westinghouse Brake & Signal Co., Ltd., Duckitt, H., and Tillotson, P.—D.c. track circuits for signalling systems. 26th October, 1956. (823044/5.) 31465. Track circuits for railway signalling systems. 26th October, 1956. (823046.)

31591. Philco Corporation.—Frequency variation detectors. 4th November, 1955. (822807.)

32412. Libbey-Owens-Ford Glass Co.—Reducing electrically conducting metal oxide films. 12th November, 1955. (822895.)

33485. National Research Development Corporation.—Waveguide hybrid devices. 21st November, 1956. (823379.)

34641. Siemens & Halske A.G.—Apparatus for the ultrasonic testing of objects. 2nd December, 1955. (822898.)

34964/5. Philips Electrical Industries, Ltd.—Position selecting, scanning and like systems. 6th December, 1955. (Divided out of 823201.) (823218/9.)

35312. Paar, J.—Impedance bridge arrangement including an energising transistor oscillator. 8th December, 1955. (823151.)

36215. Green & Silley Weir, Ltd., R. & H.—Electric proximity control systems. 12th December, 1956. (822900.)

36723. Telefunken G.m.b.H.—Angle modulation detectors, in particular ratio detectors. 22nd December, 1955. (823380.)

36782. Philco Corporation.—Cathode-ray tubes. 22nd December, 1955. (822903.)

36899. Metropolitan-Vickers Electrical Co., Ltd.—Arrangements for switching or controlling direct currents in a.c. rectifying circuits. 22nd March, 1957. (823537.)

37284. Kahn, L. R.—Single sideband transmission systems. 29th December, 1955. (823538.)

1956

823. Soc. d'Etudes Fabrication Recherches en Appareils de Mesure Sefrain, and Thulin, S.A.—Photo-electric device for measuring and regulating purposes. 10th January, 1956. (823539.)

1092. International Telemeter Corporation.—Secrecy television systems. 12th January, 1956. (823541.)

1643. Stahlwerke Bochum A.G.—Means for measuring effective and reactive components of low frequency alternating voltages and currents. 18th January, 1956. (822905.)

2017. British Thomson-Houston Co., Ltd. (General Electric Co.).—Travelling wave tubes. 20th January, 1956. (823134.)

2448. Post, R. F.—Method and means for electron acceleration. 25th January, 1956. (822906.)

2495. General Electric Co.—Velocity modulation electron discharge devices. 25th January, 1956. (823135.)

2643. Sangamo Weston, Ltd.—Electric transformers. 26th January, 1956. (823386.)

4092. General Electric Co.—Television receivers for colour television signals. 9th February, 1956. (823389.)

4316. British Insulated Callender's Cables, Ltd., and British Insulated Callender's Construction Co., Ltd.—Means for supporting overhead electric traction conductors. 8th February, 1957. (Cognate applications 24341, 8th August, 1956, and 36285, 27th November, 1956.) (823058.)

4458. Marx, C. T.—Connections for coaxial electric cables. 13th February, 1957. (823059.)

6384. Hoover, Ltd.—Suction cleaners. 29th February, 1956. (823145.)

6469. Metropolitan-Vickers Electrical Co., Ltd.—Ring counter circuit arrangements. 1st March, 1956. (823231.)

7518. Compagnie Française Thomson-Houston.—Arrangements for cooling electronic tubes. 9th March, 1956. (823156.)

7872. British Telecommunications Research, Ltd.—Electrical control circuits. 6th March, 1957. (822963.)

7979. Mullard Radio Valve Co., Ltd.—Scanning and display devices for television and like purposes. 17th December, 1956. (Cognate application 11723, 17th April, 1956.) (822911.)

8847. Metropolitan-Vickers Electrical Co., Ltd.—A.c. traction equipments. 15th March, 1957. (823547.)

9679. General Electric Co., Ltd., and Farnsworth, J.—Methods of manufacturing electric capacitors and resonant circuits including such capacitors. 26th March, 1957. (823033.)

9882. International Computers & Tabulators, Ltd.—Transducers. 27th February, 1957. (823549.)

10081. Dirks, G.—Control means for office machines controlled electrically by signals. 3rd April, 1956. (823596.)

13533. Igranic Electric Co., Ltd.—Electrical control apparatus for machines. 2nd May, 1956. (823554.)

13808. Erie Resistor Corporation.—Bender type piezo-electric transducer. 4th May, 1956. (823241.)

14393. Babcock & Wilcox, Ltd.—Tubulous vapour generating and vapour heating units. 9th May, 1956. (822817.)

15448. General Electric Co., Ltd.—Electric space heaters. 17th May, 1957. (823398.)

15606. General Electric Co., Ltd.—Electric capacitor assemblies. 20th May, 1957. (823034.)

17011. General Electric Co.—Semiconductor trigger circuits. 1st June, 1956. (823244.)

19171. Guardigli, P.—Step-by-step electric motor arrangements. 20th June, 1956. (822925.)

19874. Imperial Chemical Industries, Ltd.—Electrolytic cells. 14th June, 1957. (823598.)

20260. Siemens & Halske A.G.—Magnetisable cores made of sintered oxides and methods of manufacturing such cores. 29th June, 1956. (Addition to 803625.) (823402.)

21360. Pye, Ltd.—Coupling for transmission lines. 10th July, 1957. (823403.)

21619. General Electric Co., Ltd.—Mine winders or the like. 3rd July, 1957. (823253.)

22444. Hilger & Watts, Ltd., and Riley, D. P.—X-ray tubes. 19th July, 1956. (823162.)

23230. Westinghouse Electric International Co.—Silicon semiconductor devices. 27th July, 1956. (823559.)

24948. Imperial Chemical Industries, Ltd.—Electrolytic cells. 12th August, 1957. (823599.)

26814. Hopkins, A. O.—Scanning systems for television and like purposes. 30th July, 1957. (823573.)

31092. Casanova, J. A.—Balanced electric modulator circuit. 12th October, 1956. (822924.)

32095. Parmeko, Ltd.—Electric circuit wiring. 22nd October, 1957. (823269.)

32189. General Electric Co., Ltd.—Digital data storage apparatus. 22nd October, 1957. (822937.)

32342. Leece-Neville Co.—Alternator-rectifier generating system. 23rd October, 1956. (823575.)

32588. Standard Telephones & Cables, Ltd.—High frequency transformer. 25th October, 1956. (823421.)

32979. Ericsson Telephones, Ltd.—Magnetic switching devices. 10th October, 1957. (823422.)

33150. M-O Valve Co., Ltd., Gore, D. C., and Widdowson, A. E.—Electric discharge devices. 30th October, 1957. (823095.)

33423. Marconi's Wireless Telegraph Co., Ltd.—Frequency spectrum analysers. 16th July, 1957. (823425.)

35194. Hoover, Ltd.—Suction cleaners. 16th November, 1956. (823146.)

35568. Triggs, E. E. A. F.—Domestic electric floor polishers. 3rd May, 1957. (823576.)

36261. Parolle Electrical Plant Co., Ltd.—Control systems for nuclear power plants. 1st November, 1957. (823429.)

37048. General Electric Co., Ltd.—Manufacture of photoconductive materials. 4th December, 1957. (823187.)

37195. Metropolitan-Vickers Electrical Co., Ltd.—Process for producing sheathed wire heating elements. 5th December, 1957. (823281.)

1957

1053. Napier & Son, Ltd., D.—Electrical surface heaters. 23rd December, 1957. (823435.)

2679. Telefonaktiebolaget L. M. Ericsson.—Apparatus for reducing noise and/or cross-talk in electric pulse communication systems. 24th January, 1957. (822839.)

2687. Electric & Musical Industries, Ltd.—Printed circuits. 27th January, 1958. (823292.)

[Continued on next page

NEW PATENTS (*continued*)

3115. Compagnie Générale d'Electricité. —Connecting device for waveguides with circular cross-section and different diameters. 29th January, 1957. (823565.)

5737. U.D. Engineering Co., Ltd.—Photo-electric inspection apparatus. 20th February, 1958. (823438.)

5934. Maschinenfabrik Oerlikon.—Impulse voltage withstanding winding, more particularly for transformers. 21st February, 1957. (823566.)

6102. Sylvania Electric Products, Inc.—Electronic counter. 22nd February, 1957. (823567.)

6587. Metropolitan-Vickers Electrical Co., Ltd.—Circuit-breaker arrangements. 2nd February, 1958. (822844.)

6929. Gratzmuller, J. L.—Hydraulic control apparatus more especially for the control of circuit-breakers. 1st March, 1957. (823444.)

7747. Standard Telephones & Cables, Ltd.—Electric submarine cable having protective armouring consisting of jointed tube lengths. 8th March, 1957. (823569.)

8172. Siemens-Schuckertwerke A.G.—Hall generators. 12th March, 1957. (823299.)

9662. Bristol Co.—Electric transformers and measuring apparatus utilising same. 25th March, 1957. (823570.)

9880. British Thomson-Houston Co., Ltd., and Blake, L. R.—Electromagnetic interaction pumps. 17th March, 1958. (823110.)

10701. Republic Steel Corporation.—System for compensation of electrical strain-gauge load cell non-linearity. 2nd April, 1957. (822849.)

11522. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 24th January, 1958. (823451.)

11759. M-O Valve Co., Ltd.—Manufacture of grid electrodes for electric discharge devices. 10th April, 1958. (822972.)

13071. British Thomson-Houston Co., Ltd.—Radar display systems. 4th July, 1958. (822975.)

15017. Decca Record Co., Ltd.—Blocking oscillator circuits. 16th July, 1958. (823315.)

15584. Philips Electrical Industries, Ltd. —Methods of coating aluminium electrodes with insulating oxide layers. 16th May, 1957. (823457.)

15756. Western Electric Co., Inc.—Methods of making semiconductor bodies. 17th May, 1957. (823317.)

18246. Standard Telephones & Cables Ltd. (International Telephones & Telegraph Corporation).—Temperature compensated transistor circuit. 7th June, 1957. (822771.)

18404. General Electric Co.—Semiconductor device construction. 11th June, 1957. (822770.)

19435. Telefunken G.m.b.H.—High frequency amplifiers. 20th June, 1957. (822591.)

19622. Siemens-Schuckertwerke A.G.—Transistor circuits. 21st June, 1957. (823466.)

19811. Philips Electrical Industries, Ltd. —Electrical networks for frequency modulated signals. 24th June, 1957. (823467.)

20523. General Electric Co., Ltd.—Colour television receivers. 24th June, 1958. (822987.)

20537. Messner, E.—Electrolytic cells. 28th June, 1957. (822665.)

20689. Horizons Titanium Corporation. —Electrolytic apparatus. 1st July, 1957. (823126.)

21249. Lodge-Cottrell, Ltd.—Electrostatic precipitators. 3rd July, 1958. (822593.)

23409. Compagnie des Freins et Signaux Westinghouse. — Semiconductor rectifier assembly. 24th July, 1957. (823350.)

23455. Telefonaktiebolaget L. M. Ericsson.—Radar apparatus for indicating the range and direction of objects. 24th July, 1957. (823474.)

25003. Allmanna Svenska Elektriska A.B.—Device for protecting an electric plant against overvoltages. 8th August , 1959. (823475.)

25418. Du Pont de Nemours & Co., E. I. —Purging of electric furnaces. 12th August, 1957. (823353.)

26665. General Motors, Ltd.—Thermo-responsive electric switch. 3rd April, 1958. (823358.)

28262. Epstein, P. C., and Schild, R.—Inductor pressure transducers. 4th October, 1957. (823323.)

29105. Patent-Treuhand-Gesellschaft für Elektrische Glühlampen.—Exhausting apparatus for lamp and radio bulbs and the like. 16th September, 1957. (823120.)

32945. Mullard, Ltd.—Semi-conductive devices. 22nd October, 1957. (822678.)

35646. Western Electric Co., Inc.—Automatic telephone switching system. 15th November, 1957. (822141.)

36974. Standard Telephones & Cables, Ltd.—Co-ordinate switching equipment. 27th November, 1957. (822218.)

37010. Commissariat à l'Energie Atomique.—Piles of moderator and/or reflector elements for nuclear reactors. 27th November, 1957. (822788.)

38844. Standard Telephones & Cables, Ltd.—Two-wire two-way time division multiplex system. 13th December, 1957. (823190.)

38879. British Thomson-Houston Co., Ltd.—Electric lighting fittings of the well-glass type. 13th December, 1957. (822433.)

39254. Siemens & Halske A.G.—Page-printing typewriters and teleprinters. 17th December, 1957. (822600.)

39832. Arrow Electric Switches, Ltd.—Overload electric switch with ambient temperature compensation. 23rd December, 1957. (822130.)

40041. Siemens-Schuckert (Great Britain), Ltd.—Electric cable connectors. 24th December, 1957. (822253.)

40321. Collins Radio Co.—Sweep frequency generator. 30th December, 1957. (822254.)

40336. Svenska Relafabriken A.B.—Devices for the protection of electrical apparatus against excess voltage. 30th December, 1957. (823497.)

1958

161. General Motors Corporation.—Method of making electric storage batteries. 2nd January, 1958. (823195.)

716. Allmanna Svenska Elektriska A.B.—Heterogeneous nuclear reactors. 8th January, 1958. (822220.)

1135. Westinghouse Electric International Co.—Nuclear reactor fuel element assemblies and methods of manufacturing same. 13th January, 1958. (822790.)

2252. Mochi, E. G.—Condensers having a tantalum anode and silver cathode. 23rd January, 1958. (823501.)

4489. Telefonaktiebolaget L. M. Ericsson. —Lifting card for electric relay spring sets. 11th February, 1958. (822257.)

4888. Standard Telephones & Cables, Ltd.—Mounting arrangements for electric equipment. 14th February, 1958. (823508.)

6169. Standard Telephones & Cables, Ltd.—Electrical counting chains. 26th February, 1958. (822691.)

6794. Allis-Chalmers Manufacturing Co. —Dynamo-electric machine core winding. 3rd March, 1958. (822221.)

8101. Dole Refrigerating Co.—Electric circuits for operating fan motors. 13th March, 1958. (822454.)

8787. Telefunken G.m.b.H.—Electrical arrangement for converting decimal numbers into binary numbers or vice versa. 19th March, 1958. (823513.)

8909. Allmänna Svenska Elektriska A.B. —Electric stirring means for metallurgical furnaces. 20th March, 1958. (823018.)

9280. Heath & Sons, Ltd., S.—Standards primarily for electric standard lamps. 24th March, 1958. (822795.)

12628. Henley's Telegraph Works Co., Ltd., W. T.—Cable connectors. 21st April, 1958. (Addition to 796569.) (822144.)

17354. Standard Telephones & Cables, Ltd.—Circuit arrangement for obtaining automatic gain control. 30th May, 1958. (822158.)

18364. Yeowell, F. W.—Television and like aerials. 9th June, 1958. (822479.)

29484. Electrol, Inc.—Electro-hydraulic actuators. 15th September, 1958. (Divided out of 822164.) (822165.)

32648. Stamicarbon N.V.—Electric heating apparatus. 25th November, 1955. (Divided out of 822149.) (822150.)

1959

9428. Bird Electronic Corporation.—Attenuating units for coaxial transmission lines. 4th October, 1955. (823029.) 9846. Couplings for transmission lines. 4th October, 1955. (Divided out of 823028.) (823030.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 28th November:—

Creda Cutie. No. 786,950. Class 7. Machines for washing, drying and ironing. **Creda Cutie.** No. 786,951. Class 11. Electrical heating and cooking apparatus. **Creda Cresta.** No. 791,373. Class 11. Electric fires and space heaters.—Simplex Electric Co., Ltd., Broadwell, Oldbury, near Birmingham.

Stella. No. 788,386. Class 8. Electric shaving instruments.—Stella Lamp Co., Ltd., 158-160, Shaftesbury Avenue, London, W.C.2.

Isostart. No. 781,413. Class 9. Accumulators, batteries and galvanic cells, and parts; and separators and diaphragms.—Accumulatoren-Fabrik, Akt.-Ges., Hagen, Westphalia, Germany. Address for service, c/o Edward Evans & Co., 53-64, Chancery Lane, London, W.C.2.

Gala. No. 782,729. Class 9. Electrical instruments and apparatus, but not including sound reproducing apparatus.—A.E.I.-Hotpoint, Ltd., 33, Grosvenor Place, London, S.W.1.

AEI (design). No. 785,587. Class 9. Scientific, nautical and surveying apparatus and instruments; electrical apparatus and instruments; cinematographic, optical, weighing, measuring, signalling, checking (supervision), radio, and coin or counter-freed apparatus; talking machines, calculating machines. **AEI** (design). No. 785,589. Class 11. Installations for lighting, heating, steam generating, cooking, refrigerating, drying and ventilating purposes.—Associated Electrical Industries, Ltd., 33, Grosvenor Place, London, S.W.1.

Vox. No. 786,137. Class 9. Electrical and electronic instruments and apparatus; record players, magnetic tape recorders, etc.—Jennings Musical Industries, Ltd., Unity House, Dartford Road, Dartford, Kent.

Con-Elco. No. 790,615. Class 9. Variable electrical resistances.—Con-Elco, Monrovia, Cal., U.S.A. Address for service, c/o W. P. Thompson & Co., 12, Church Street, Liverpool, 1.

Dynamic Eye. No. 791,542. Class 9. Spot lights and projectors therefor. **Dynamic Eye.** No. 791,543. Class 11. Lighting installations and lighting appliances.—Courtney, Pope (Electrical), Ltd., Amhurst Park Works, Seven Sisters Road, Tottenham, London, N.15.

Supapac. No. 782,403. Class 11. Boilers (not parts of machines).—John Thompson, Ltd., Ettingshall Engineering Works, Wolverhampton.

Velvair. No. 788,982. Class 11. Electrical heating apparatus.—Dorman & Smith, Ltd., Atherton Works, Blackpool Road, Preston.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 16th NOVEMBER

Birmingham.—Grand Hotel. Birmingham Electric Club. "Electric Motor Types and Utilisation," by H. Sterling.

Brigg.—Angel Hotel, 6.45 p.m. I.E.E. Sheffield Sub-Centre. "Electrification of the U.K.A.E.A. Industrial Group Factories," by J. W. Binns and W. J. Outram.

Bristol.—S.W.E.B. Demonstration Theatre, Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Supply Group. "British Columbia-Vancouver Island 138 kV Submarine Power Cable," by T. Ingledow, R. M. Fairfield, E. L. Davey, K. S. Brazier and J. W. Gibson.

Grand Hotel, 8 p.m. A.S.E.E. Bristol and West of England Branch. "Aircraft Electrical Installation."

Halifax.—Percival Whitley College of Further Education, Francis Street, 7.30 p.m. Institution of Production Engineers, East and West Ridings Region. "Electronic Copying on Machine Tools," by R. Lawson.

Ipswich.—Electric House, 7.15 p.m. Ipswich and District Electrical Association. "Electrical Safety in the Factory and in the Home," by S. J. Emerson.

Liverpool.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "The Application of Low-Pressure Resins to some High-Voltage Switchgear Designs," by T. R. Manley, K. Rothwell and W. Gray.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. informal meeting. Discussion on "Is Off-Peak Load Given Sufficient Encouragement?" opened by E. L. E. Wheatcroft.

Newcastle-on-Tyne.—Rutherford College of Technology, 6.15 p.m. I.E.E. North Eastern Measurement and Electronics Group. "The Influence of Consumers' Load/Consumption Characteristics on Metering Practice," by L. B. S. Golds.

Stafford.—Technical College, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Field Suppression of Turbo-Alternators," by J. R. Hill, A. Hunt, W. J. Joyce and D. H. Tompsett.

TUESDAY, 17th NOVEMBER

Broadstairs.—Clarendon Hotel, 8 p.m. A.S.E.E. East Kent Branch. "Overhead Equipment for Railway Electrification," by G. W. Launder.

Glasgow.—Grosvenor Restaurant, Gordon Street, 6 p.m. I.E.E. Scottish Centre. Dinner-dance.

Leeds.—Leeds University, 6.30 p.m. I.E.E. North Midland Utilisation Group. "The Provision of Adequate Electrical Installations in Buildings—Commercial Buildings," by E. E. Jacobi.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. Discussion on "Sequence Networks versus Summation Transformers for the Derivation of Single Quantities for Protective Relaying," opened by C. Adamson and Dr. E. A. Talkhan.

Magnet House, Kingsway, W.C.2, 6.30 p.m. A.S.E.E. National lecture. "Research in a Large Electrical Engineering Concern," by Dr. H. K. Cameron.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Measurement and Control Group. "Silicone Electrical Insulation," by J. H. Davis.

Newcastle-upon-Tyne. — A.S.E.E. Newcastle-upon-Tyne and District Branch. Visit to Winthrop Laboratories.

Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Graduate and Student Section. Joint debate with I.C.E. and I.Mech.E. graduates and students on "That This House Deplores the Exploration of Space."

Norwich.—Assembly House, 7.30 p.m. I.E.E. East Anglian Sub-Centre. Discussion on "The Provision of Adequate Electrical Installations in Buildings."

Oxford.—Employment Exchange, 8 p.m. A.S.E.E. Oxford and Districts Branch. "Radio Interference Suppression."

Preston.—Demonstration Theatre, North Western Electricity Board, 19, Friargate, 7 p.m. I.E.S. North Lancashire Group. "Looking at Lighting," by A. Wilcock.

South Farnborough. — Queen's Hotel, 7.30 p.m. A.S.E.E. Aldershot and District Branch. "Earth Leakage Protection," by J. A. Robbin.

WEDNESDAY, 18th NOVEMBER

Bristol.—School of Management Studies, Unity Street, 7 p.m. British Institution of Radio Engineers, South Western Section. "Data Recording and Presentation," by D. W. Thomasson.

Dartford.—Railway Hotel, 7 p.m. Institution of Plant Engineers, Kent Branch. "The Heat Pump and its Industrial Application," by A. S. Miller.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Research on the Performance of High Voltage Insulators in Polluted Atmospheres," by Dr. J. S. Forrest, P. J. Lambeth and D. F. Oakeshott.

I.E.E. London Graduate and Student Section, 2.30 p.m. Visit to A.E.I. Switchgear Division, Willesden.

1, Birdcage Walk, Westminster, 6 p.m. Institution of Mechanical Engineers, Nuclear Panel. Discussion on "To What Extent should Design Wait on Research for Nuclear Power Plant?"

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 3 p.m. and 6 p.m. British Institution of Radio Engineers. "Electronic Digitising Techniques." Half-day symposium, to be opened by G. J. Herring.

Newcastle-upon-Tyne.—Roadway House, Oxford Street, 7 p.m. Society of Instrument Technology, Newcastle Section. "The Principles and Manufacture of Junction Transistors," by P. I. Nicholson.

Nottingham.—Victoria Station Hotel, 7 for 7.30 p.m. I.E.E. East Midland Centre. Annual dinner.

E.M.E.B. Showroom Theatre, Carrington Street, 7.30 p.m. A.S.E.E. Nottingham Branch. "Protective Equipment in Industrial Plant," by Dr. W. L. Stern.

Reading.—A.S.E.E. Reading and Districts Branch. Visit to London Transport Acton Works and Signal Cabin.

Rugby.—Masonic Hall, 7 for 7.30 p.m. I.E.E. Rugby Sub-Centre. Annual dinner.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "The Provision of Adequate Electrical Installations in Buildings," by R. A. Marryat and C. A. Belcher.

The University, 7 p.m. I.E.E. Sheffield Graduate and Student Section. "Something for Nothing?—Heat Pump Achievements," by G. O. McLean.

Wolverhampton.—Chamber of Commerce, District Bank Chambers, Lichfield Street, 7.45 p.m. A.S.E.E. Wolverhampton and District Branch. "Lighting Design and Layout," by V. C. Heydon.

THURSDAY, 19th NOVEMBER

Chelmsford.—Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "Some Industrial Applications of Magnetic Power," by T. G. Hawker.

Dublin.—Trinity College, 6 p.m. I.E.E. Irish Branch. "Lighting and Architecture," by J. M. Waldram.

London.—Café Royal, W.1, 12.15 for 1 p.m. Federation of British Industries, London and South Eastern Regional Council. Annual general meeting and luncheon.

At the Institute of Marine Engineers, Memorial Building, 76, Mark Lane, E.C.3, 2.30 p.m. Diesel Engineers' and Users' Association. "Piston Assemblies for Compression Ignition Engines," by J. E. Robinson.

Portsmouth.—C.E.G.B. Offices, 6.30 p.m. I.E.E. Southern Centre. "Electrogyro Locomotive," by J. K. Gessler. (Joint meeting with the Southern Branch of the Institution of Mechanical Engineers.)

FRIDAY, 20th NOVEMBER

Edinburgh.—Roxburghe Hotel, Charlotte Square. Institution of Plant Engineers, Edinburgh Branch. Annual dinner and dance.

Leeds.—Queen's Hotel, 7 for 7.30 p.m. I.E.E. North Midland Centre. Annual dinner.

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "The Ordinary National Certificate—A New Look," opened by T. Siklos.

Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Graduate and Student Section. "Plastic Cables in the Telecommunications Industry," by G. J. Waddon.

The Feathers Hotel, The Broadway, Westminster, S.W.1, 6 for 6.30 p.m. Electrical Trades' Commercial Travellers' Association. Supper followed by annual general meeting.

Manchester.—The University. Institution of Plant Engineers, Manchester Branch. Annual dinner.

Newcastle-on-Tyne.—King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Ultra-high-frequency Tetrodes," by P. Powers.

Wembley.—Century Hotel. A.S.E.E. North West London Branch. Branch annual dinner and dance.

SATURDAY, 21st NOVEMBER

Blackpool.—Cliffs Hotel, 6.30 p.m. I.E.E. North Lancashire Sub-Centre. Annual dinner-dance.

Dundee.—Institution of Plant Engineers, Dundee Branch. Annual dinner and dance.

London.—I.E.E. London Graduate and Student Section, 10 a.m. Visit to A.E.I. Systems Engineering Department, Willesden.

Manchester.—Bavarian Suite, Belle Vue, A.S.E.E. Manchester Branch. Ladies' evening.

Catalogues and Lists

CATHODIC PROTECTION. — Leaflet (C.C.110) describing high-duty platinised titanium anodes and mountings for impressed current cathodic protection systems.—**Cathodic Corrosion Control, Ltd.**, Eastbourne Terrace, Paddington, London, W.2.

COMPUTER.—12-page booklet illustrating and describing the "Stantec-Zebra" electronic digital computer.—**Standard Telephones & Cables, Ltd.**, Newport, Mon.

ELECTRONIC SHIELDS. — Catalogue of "KnitMesh" electronic products, including radio frequency shields.—**KnitMesh, Ltd.**, 36, Victoria Street, London, S.W.1.

FANS.—32-page catalogue (2504) dealing with type MVAZ multi-vane standard and heavy duty fans.—**Sturtevant Engineering Co., Ltd.**, Southern House, Cannon Street, London, E.C.4.

LAMPS.—36-page catalogue giving prices and particulars of the "Cryselco" range of lamps.—**Cryselco, Ltd.**, Kempston Works, Bedford.

LIGHTING FITTINGS. — Illustrated folder giving particulars of a range of hospital type lighting fittings, including signs and bedhead fittings.—**T. C. Moore & Son**, 5, Westville Road, London, W.12.

Leaflet illustrating the "Lo-vo-lite" range of low voltage safety lighting fittings and transformers.—**Brookhirst Igranic, Ltd.**, Bedford Works, Bedford.

UNDER-CARPET HEATERS.—Folder describing the "Marpat" electric under-carpet heater.—**Marpat Manufacturing, Ltd.**, 27, Hart Street, Walsall, Staffs.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Aberdeen.—Corporation. 30th November. Electric lamps. (See this issue.)

Australia.—State Electricity Commission of Queensland, Brisbane. 16th December. One 15,000 kVA, 11 kV/66 kV transformer. (E.S.B. 25842/59. Ten/43051.)*

Snowy Mountains Hydro-Electric Authority. 3rd February. One 25 MVA and one 300 MVA transformers. (E.S.B. 25562/59. Ten/43052.)*

Commissioner for Railways, Sydney. 13th January. Rectifier units and harmonic filter equipment. (E.S.B. 25903/59. Ten/43094.)*

Belfast.—27th November. Electrical installation in Bloomfield Collegiate School. McCandless & Barton, consulting engineers, 6, Murray Street, Belfast.

Beverley.—R.D.C. 26th November. Two 225 g.p.m. sewage pumps, two 200 g.p.m. pumps, and two 150 g.p.m. pumps, each complete with electric motors, starters and accessories, for Wodmansey sewerage scheme. John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

Canada.—City Commissioners, Saskatoon. 8th December. Electrical substation, including circuit-breakers, transformers, etc. (E.S.B. 26036/59. Ten/43121.)*

Egypt.—Egyptian Railways. 7th December. Two 200 kW diesel-electric generating sets with accessories and switchboard for Kantara Shark power station. (E.S.B. 25737/59. Ten/43043.)*

Director General, Mechanical and Electrical Department, Ministry of Public Works. 9th January. Construction of Truga pumping station and its transformer station. (E.S.B. 25735/59. Ten/43042.)*

Farnborough (Hants.).—Corporation. 30th November. Electrical installations in 140 houses. (See this issue.)

Formosa.—Central Trust of China, Taipei. 30th November. V.h.f. radio equipment and spare parts. (E.S.B. 25547/59/I.C.A. Ten/43028.)*

France.—Headquarters Command, Purchasing and Contracting Office, S.H.A.P.E., Paris. 30th November. Incandescent and fluorescent lamps. (E.S.B. 25286/59. Ten/43180.)*

Honiton.—East Devon Water Board. 14th December. Electrically driven pumping equipment including hydro-pneumatic booster plant and standby pump for Pinhay pumping station. Engineer to the Board, The Laurels, 46, New Street.

India.—Madras State Electricity Board. 26th November. L.v. shunt capacitors. (E.S.B. 25914/59. Ten/43101.)*

Kenya.—Nairobi City Council. 30th November. Switchgear and cables. (E.S.B. 26343/59. Ten/43195.)*

Korea.—Government Office of Supply, Seoul. 24th November. Wire rope, steel rails, a.c. motors, transformers, etc. (E.S.B. 26030/59/I.C.A. Ten/43168.)*

New Zealand.—G.P.O., Wellington. 3rd December. Switchboard wire. (E.S.B. 25965/59. Ten/43097.)*

Waitemata Electric Power Board, Auckland. 11th December. One 7·5 MVA, 33 kV/11 kV transformer. (E.S.B. 26001/59. Ten/43099.)* Switchgear and fuse switches. (E.S.B. 26002/59. Ten/43136.)*

Newry.—Northern Ireland Ministry of Finance. 26th November. Electrical installation in new office building, Bridge Street. Room 103, Ministry of Finance, Law Courts Building, Belfast.

Pakistan.—Department of Supply and Development, Karachi. 25th November. Shackle insulators. (E.S.B. 25830/59/I.C.A. Ten/43117.)* 30th November. Insulated cables. (E.S.B. 26049/59. Ten/43114.)*

Department of Supply and Development, Chittagong. 30th November. 220 V d.c. Ah meters. (E.S.B. 26234/59. Ten/43191.)*

Rushden.—U.D.C. 2nd December. Two vertical spindle unchokeable centrifugal pumps of 300 g.p.m. capacity each, together with equipment. Engineer and surveyor, Council Buildings.

South Africa.—Stores Department, South African Railways. 27th November. Switchboards and transformers. (E.S.B. 25779/59. Ten/43040.)*

Johannesburg Corporation. 23rd November. Electric tilting furnace. (E.S.B. 26427/59. Ten/43216.)*

Tredegar.—U.D.C. 30th November. Street lighting equipment. (See this issue.)

Trinidad.—Trinidad and Tobago Electricity Commission, Port of Spain. 30th November. Insulated cables. (E.S.B. 25994/59. Ten/43104.)*

ORDERS PLACED

Birkenhead.—Corporation. Electric floor heating in new office block at the corner of Cleveland Street and Argyle Street, for the Borough Treasurer's Department (£3,859).—Merseyside and North Wales Electricity Board.

Durham.—County Council. Electrical installation in new County Offices (£114,044).—Rashleigh Phipps & Co. Electric wiring of various rooms at Bowes Museum (£1,617).—Cox-Walkers.

Glasgow. — British Railways, Scottish Region. Three diesel-electric mobile cranes for goods stations.—Steels Engineering Products. Colour-light signalling south of the River Clyde.—Westinghouse Brake & Signal Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberdeen.—Houses and maisonnettes (170), in multi-storey block, Chapel Street/Skene Street area; G. Keith, city architect, 11, Broad Street, Castlegate.

Annan.—Extensions to Annan Academy (£262,000); county architect, County Offices, Dumfries.

Bedford.—Six-storey block of municipal offices (£230,000); borough architect.

Showrooms and offices, 3, High Street; Carl Fisher, architect, 56, Portland Place, London, W.1.

Belfast.—Houses (369), Turf Lodge estate; housing architect, 97, Townsend Street.

Bentley (Yorks.).—Bungalows (106) for old people; U.D.C. surveyor.

Birchington.—Bungalows (62), Canterbury Road; Francis Jackson, Ltd., Glebe Avenue, Ickenham.

Bristol.—Swimming baths, Filwood Broadway (£150,000); planning officer, Cabot House, Deanery Road.

Caistor (Lincs.).—Block of welfare flats (£20,500); R.D.C. surveyor.

Cannock (Staffs.).—Central bus station; E. Lomax, U.D.C. surveyor, Council House.

Cardiff.—Extension of James Howell's departmental stores, St. Mary Street; Bruton & Mace, architects, 31, Cathedral Road.

Glasgow.—Houses (504), Easterhouse; director of housing, 20, Trongate.

Godalming. — Laboratories; Guildford Laboratories, Ltd., 56, Buckingham Gate, London, S.W.1.

Gretna.—Comprehensive secondary school (£120,000); county architect, County Offices, Dumfries.

Halesowen.—Flats and maisonnettes (80); A. T. Butler & Partners, architects, 31, Priory Street, Dudley.

London.—Additional floor to Adelaide House, London Bridge; St. Martin's-le-Grand Property Co., Ltd., Empire House, E.C.1.

Hall and offices, Oat Lane, E.C., for Worshipful Company of Pewterers; Holloway Bros., Ltd., 157, Millbank, S.W.1.

Factory, Holmes Road, St. Pancras; Mitchell Colourcard Co., Ltd., 5, Sandall Road, N.W.5.

Maidenhead.—Town Hall and municipal offices; North & Partners, architects, 40, Broadway.

Middlesbrough.—Physiotherapy department at Middlesbrough General Hospital; Newcastle-on-Tyne Hospital Board, Benfield Road, Newcastle-on-Tyne.

R.C. church, North Ormesby (£40,000); F. Keelan, Ltd., builders, King Street, Thornaby-on-Tees.

Office block, Albert Road, for Bradford Equitable Building Society; Hudson Brothers, builders, Fidler Street.

Houses (80), Ruskin Avenue area; E. T. Sweeting & Son, builders, Back Haymore Street.

Mitcham (Surrey).—Second floor extensions with lift; Mitcham Food Products, Ltd., 2, Commonside East.

New Forest.—Houses (97); F. R. Appleby, clerk, R.D.C. Offices, Lyndhurst, Hants.

Norfolk.—Old people's homes at Aylsham and Swaffham; county architect, 27, Thorpe Road, Norwich.

Portsmouth.—Works extensions; Hinchley Engineering Co., Ltd., Unicorn Road.

Rochdale.—Kingsway Secondary Modern School, municipal offices and civic centre; borough engineer, Town Hall.

Sheffield.—Church of St. John, Gleadless Valley; Hadfield, Cawkwell & Davidson, architects, 17, Broomgrove Road.

Southampton.—Flats, Northam (125) and Millbrook (120); borough engineer, Civic Centre.

Swansea.—Physics, chemistry and metallurgy block, Technical College; borough architect.

Flats (198), Sketty Park estate; Geo. Wimpey & Co., Ltd., Newport Road, Cardiff.

Tottenham. — Development scheme (£100,000), Prince of Wales Hospital; N.E. Metropolitan Regional Hospital Board, 40, Eastbourne Terrace, W.2.

Tynemouth.—New Whitehouse Primary School; J. G. Cowe & Son, architects, Claremont Place, Newcastle-on-Tyne.

Watford.—Bacon factory for H. Kingham & Sons, Ltd., High Street; Turriff Construction Corporation, Ltd., Budbrooke Road, Warwick.

Welwyn Garden City.—Houses (274), for Development Corporation; general manager, 4, Wigmores South, Howardsgate.

York.—Works extensions; Rowntree & Co., Ltd., Cocoa Works.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).